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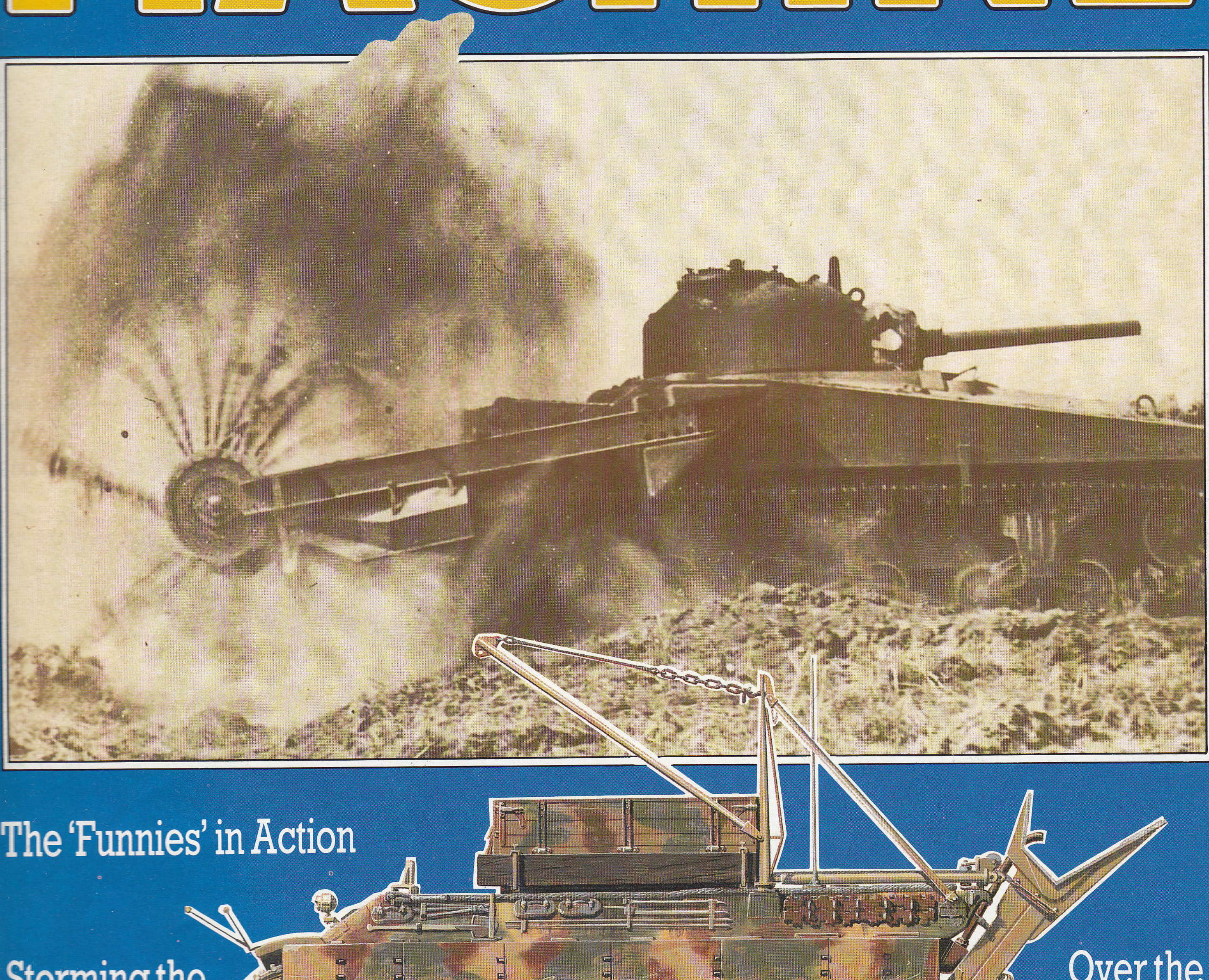

The 'Funnies' in Action

Storming the Atlantic Wall

Over the Minefield

A fully illustrated guide to Special Purpose Tanks of World War II

WAR MACHINE

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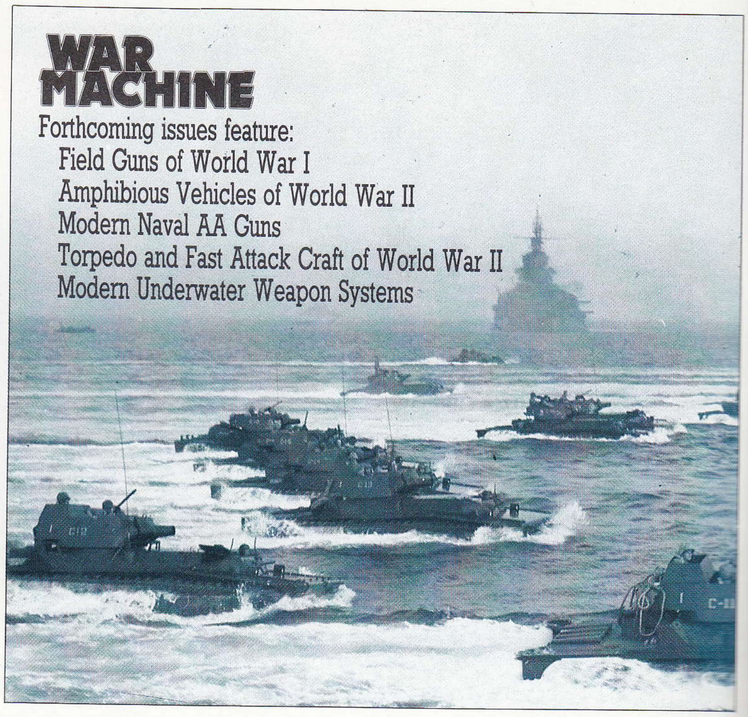

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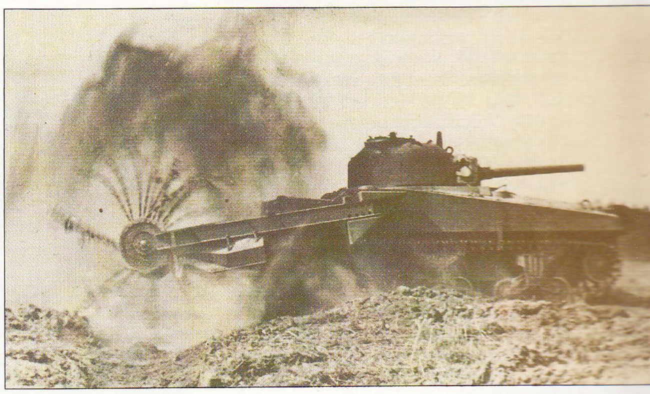
Special Purpose Tanks of World War 11

Modern armies can call upon a whole family of specialist armoured vehicles for combat engineering operations, but in World War II special purpose vehicles were a novelty. Several nations developed tanks for roles such as armoured recovery, but Britain led the way with a bewildering variety of tank conversions rejoicing in the title of 'Funnies'.



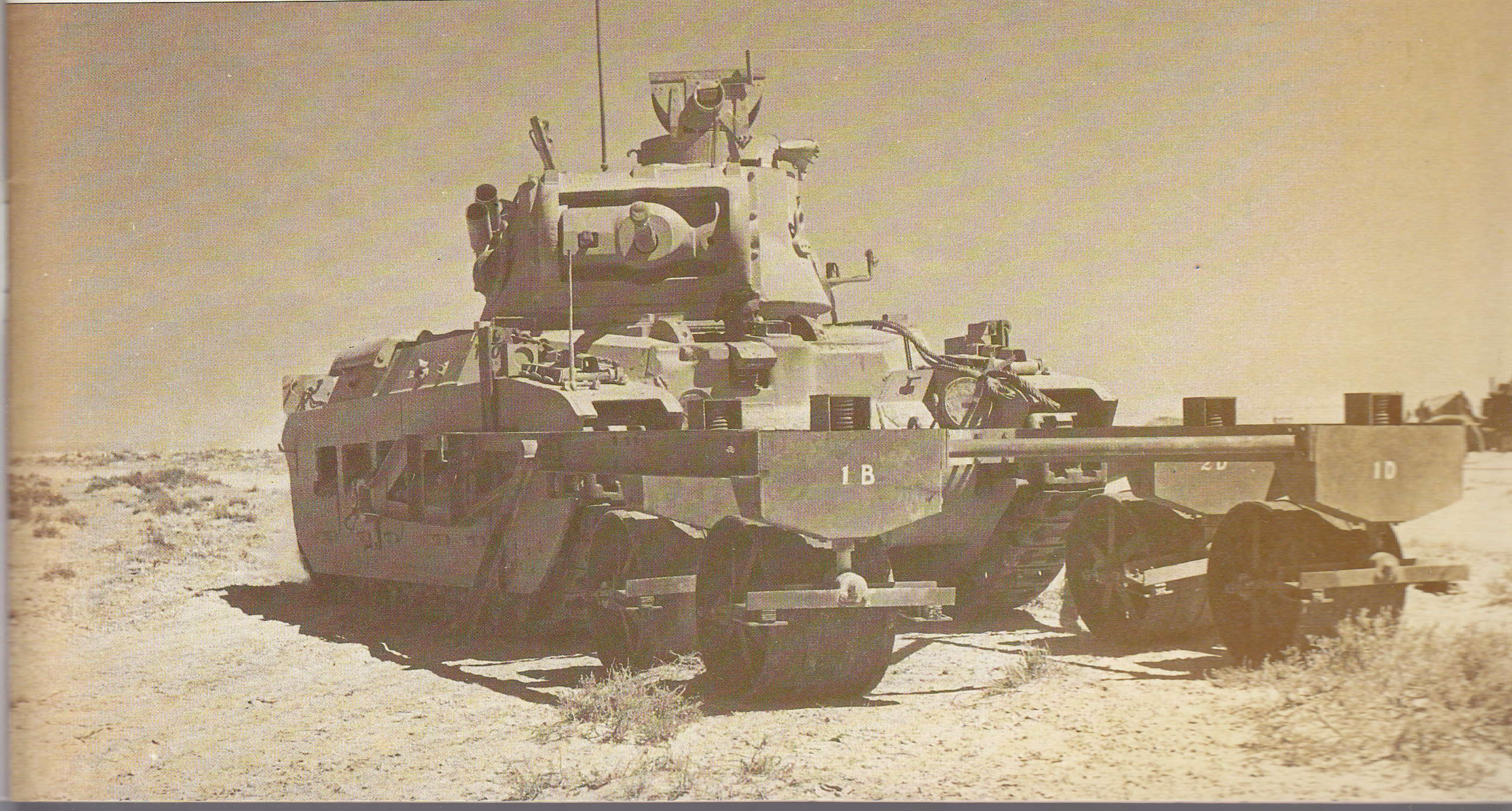
This Sherman Crab flail tank in action clearly shows the amount of dust and dirt that these anti-tank mine flails could produce. Sherman Crabs were used by the 79th Armoured Division on D-Day and after, and a small number were passed to the US Army during 1944.

The contents of this study show something of an imbalance in comparison with those of others in this series, for they deal mainly with the many types of special-purpose vehicles used by the British 79th Armoured Division. For once there is no preponderance of US designs because during World War II the Americans spent little of their considerable potential on the types of vehicle included here. They concentrated on combat vehicles pure and simple, and from the factories of the United States poured streams of combat tanks and all manner of fighting vehicles.

But it was a different matter once these reached Europe. There many of them were reworked for special purposes, vehicles ranging from armoured engineer vehicles to mine-clearing tanks of several types. It was different as far as the British were concerned: they had a special task to perform, namely the invasion of Europe in order to take on the German army on the continent. The only way they could do that was by using special vehicles of all kinds, those which could clear battlefield obstacles, recover precious disabled vehicles and perform special tasks such as burning out stubborn strongpoints. The Germans and Americans did not bother to use specialist vehicles on such scale. Instead they decided to make do with what they had, and they often suffered accordingly. For the simple fact is that many of the vehicles included here actually saved lives. Combat engineers operating from inside the protection of an armoured vehicle were much safer in action than hapless soldiers attempting to work out in the open, and men using mine-clearing tanks of whatever type were safer than men using manual clearing methods.

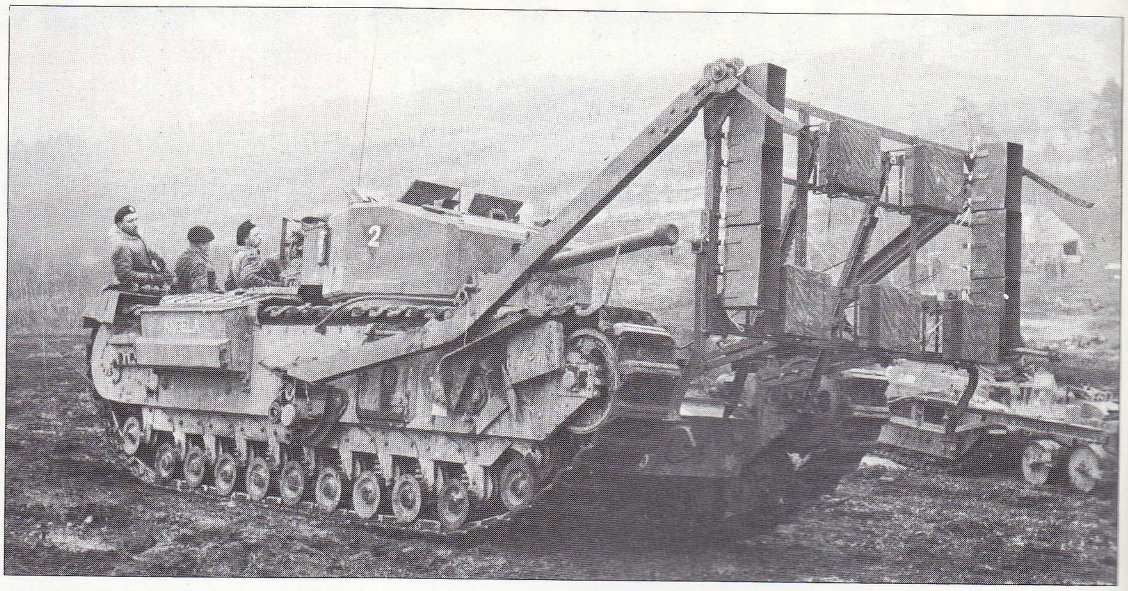
But not all special purpose vehicles fell into this category. Those described here include command vehicles, ammunition or cargo carriers, and even such oddities as the Rammtiger that was supposed to knock down buildings in urban warfare. They are a motley bunch but full of interest and a subject of study in their own right.

A Matilda AMRA (Anti-Mine Roller Attachment) is seen in 1942. These anti-mine rollers were meant to detonate mines by simply rolling over them and were originally developed for use with the early Cruiser tanks. The Matilda was not the only tank to use this device; some were fitted to Valentines.



UK

Demolition charges



The Jones Onion, seen here carried by a Churchill tank, was a demolition device carried on a steel frame that could be placed against an obstacle such as an anti-tank wall. The frame was then released to allow the tank to retire and detonate the charge.

The demolition charges used by the British 'Funnies' were nearly all carried by Churchill AVREs, for the emplacing of these special powerful charges was one of the tasks for which the AVRE was intended. The charges themselves were special obstacle-demolishing packs of high explosive that had to be placed against the target, which might be anything from a sea or anti-tank wall to a blockhouse or an offending building. Sometimes the charges were large single chunks of explosive, and in others they were small charges set in a pattern and held in a steel frame. One thing all the various charges did have in common and that was odd and even bizarre names.

One of the more straightforward of these charge devices was the **Bangalore Torpedo**. These pipe charges were intended for mine- or barbed wire-clearing, but could be used for other purposes and on the AVRE they were held in front-mounted frames, also used for the **Jones Onion**. The Jones Onion first appeared in 1942 and was the codename given to a frame onto which various charges could be attached. The frame was carried on two arms, one on each side of the AVRE, and was held upright as the target was approached. Once in position the frame was released by pulling on a cable and two legs on the bottom of the frame were so arranged that the frame always fell against the target obstacle. The charges could then be fired electrically by a trailing cable after the AVRE had reversed away. The side-mounted arms could then be jettisoned if required.

Another device that appeared in 1942 was the **Carrot**. This was a much simpler device than the large Onion and consisted of a charge held in front of the AVRE on a simple steel arm. The idea was that the AVRE simply moved up to the target and the charge was then ignited. The charges involved ranged in weight from 5.44 kg (12 lb) up to 11.34 kg (25 lb), the smaller charge rejoicing in the name of **Light Carrot**. The Carrot was used extensively for trials but was abandoned during late 1943 and was not used in action.

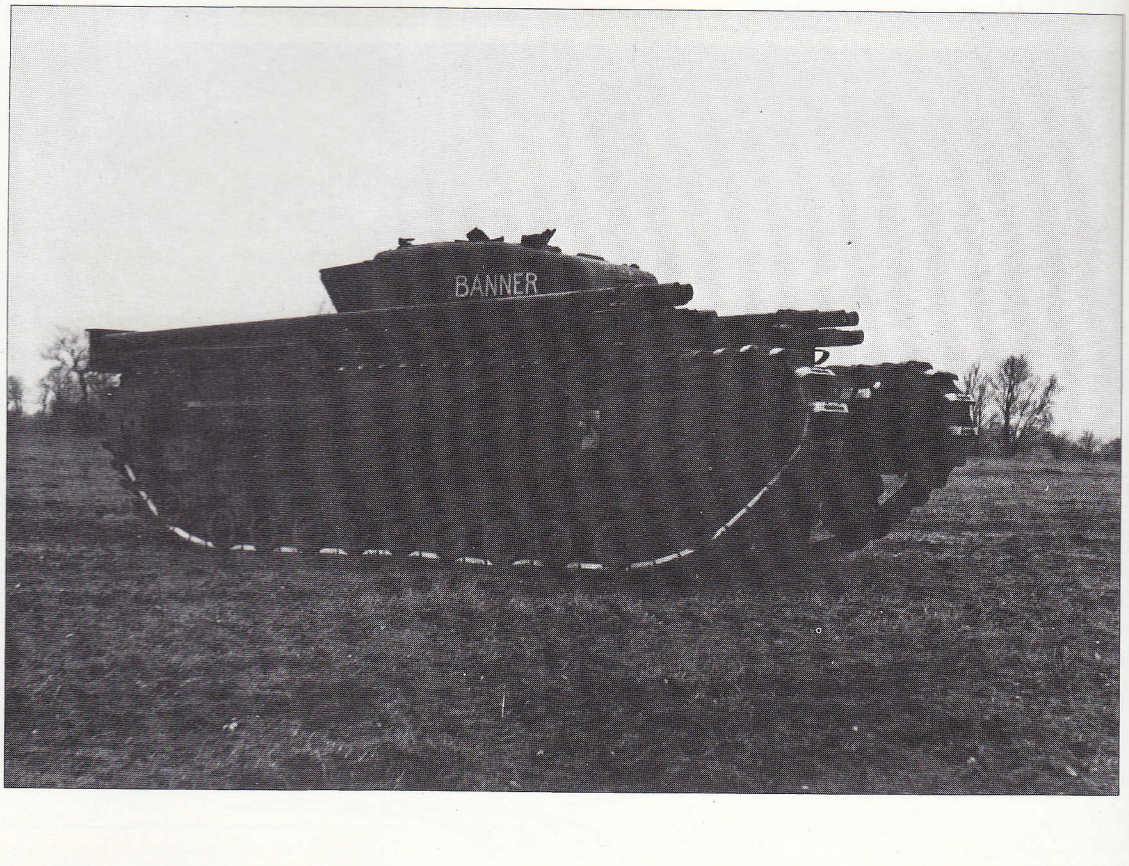
However, the **Goat** was used in action. This may be considered as a development of the Onion but it was much larger and involved the use of a frame 3.2 m (10 ft 6 in) wide and 1.98 m (6 ft 6 in) long. Onto this frame could be arranged up to 816 kg (1,800 lb) of explosive, and the whole device was carried on the AVRE by side arms. The Goat was so arranged that it could be pushed against the structure to be demolished and the frame would then automatically release in a vertical position. The AVRE would then reverse away leaving the charges in position to be fired either electrically or by means of a pull igniter. A close cousin of the Goat was the **Elevatable Goat**. This was intended for use against high obstacles such as anti-tank walls, and when fitted on the AVRE was carried on the nose of the hull rather like an assault bridge. The 'bridge' was in fact a frame on which linked charges were slung. The frame was placed against the wall to be demolished and then released from the AVRE. Once in position another release cable allowed the linked charges to fall away from the frame. The top section of the frame was above the top of the wall, and this allowed the charges to fall onto each side of the wall, which could then be destroyed once the AVRE had moved away.

UK

Bangalore Torpedo tanks

The **Bangalore Torpedo** is an ancient combat engineering device that was revived during World War I for clearing barbed-wire entanglements. In its simplest form the Bangalore Torpedo is a metal tube filled with explosive and sealed at both ends. Most types have attachment points at each end to enable other torpedoes to be joined to make up extra lengths. The charges are set off either by a burning fuse or by some form of remote detonator. These torpedoes were soon in use by armoured combat engineers to clear paths through minefields, and simple delivery devices such as that fitted to the front of a Churchill AVRE were soon devised.

However the normal Bangalore Torpedo is only about 1.5 m (5 ft) long, and armoured engineers were often called upon to bridge minefields many metres deep. It would obviously save time and effort if longer torpedoes could be joined up to clear paths through deep minefields, and this course of action was followed to produce the 76.2-mm (3-in) **Snake**. On the Snake the lengths of explosive-filled



The Snake was a form of Bangalore Torpedo used to clear large minefields. Seen here carried on a Churchill, the Snake was assembled on the edge of a minefield, pushed across it by the tank and then detonated to clear a path.

tubing or pipe were 6.1 m (20 ft) long and could be joined together into lengths of up to 366 m (1,200 ft) to enable them to be pulled across a minefield and then detonated to clear a path up to 6.4 m (21 ft) wide. It was better if the Snake tubing could be pushed across a minefield, but when this happened the lengths involved were less. Only 122 m (400 ft) of Snake tubing could be pushed in front of a tank with any degree of control. The tanks involved with Snake were usually Shermans or Churchill AVREs, but the Royal Engineers did also have small numbers of a special vehicle. This was known as the **Snake Carrier** and was a conversion of the Churchill Gun Carrier, a Churchill variant with a box superstructure that had been intended to mount a 76.2-mm gun for use as a tank destroyer. For a number of reasons the Churchill Gun Carrier was not accepted for service and the few vehicles involved carried Snake instead, on both sides of the box superstructure. The Gun Carrier moved the tubing to a point close to the target, and here the crew assembled the Snake, which was then pushed into position across the minefield and detonated. Although Snake was used for training and trials it was not used operationally.

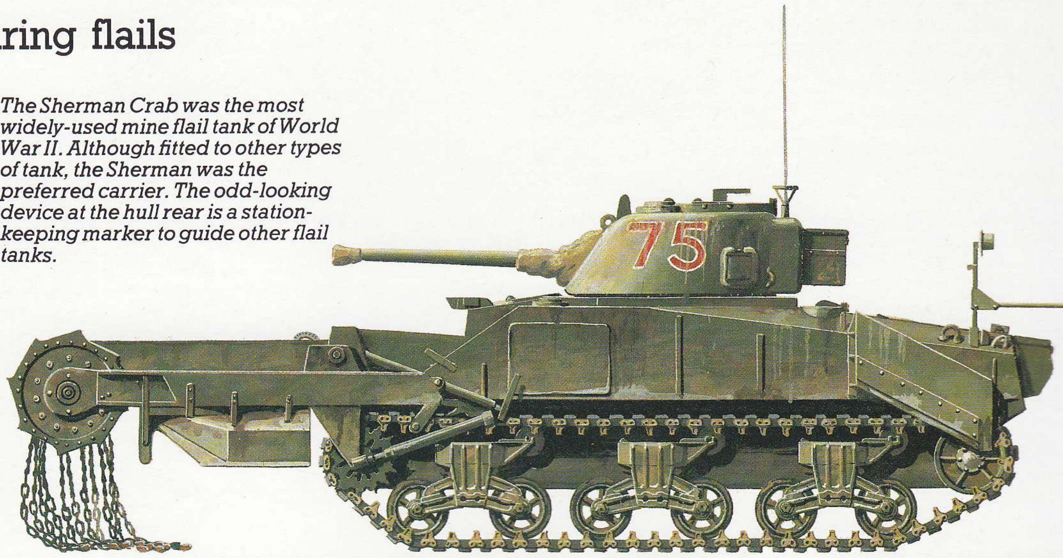
The **Conger** was towed behind a Churchill AVRE or a Sherman in an engineless Universal Carrier that carried a rocket, a length of hose and a tank of liquid explosive. The rocket carried the hose across the minefield, and when in place the hose was filled with the liquid explosive and detonated. The **Tapeworm** was another hose device that was carried in a trailer to the edge of a minefield where it was deposited. A tank with a CIRD (Canadian Indestructible Roller Device) then moved across the minefield and as it proceeded the tank pulled the explosive-filled hose across the minefield. When the full length of hose (457 m/500 yards) had been pulled from the trailer the explosive was detonated to clear any mines that might have been missed by the rollers. The 15.2 m (50 ft) of hose nearest to the towing tank was filled with sand for safety purposes.

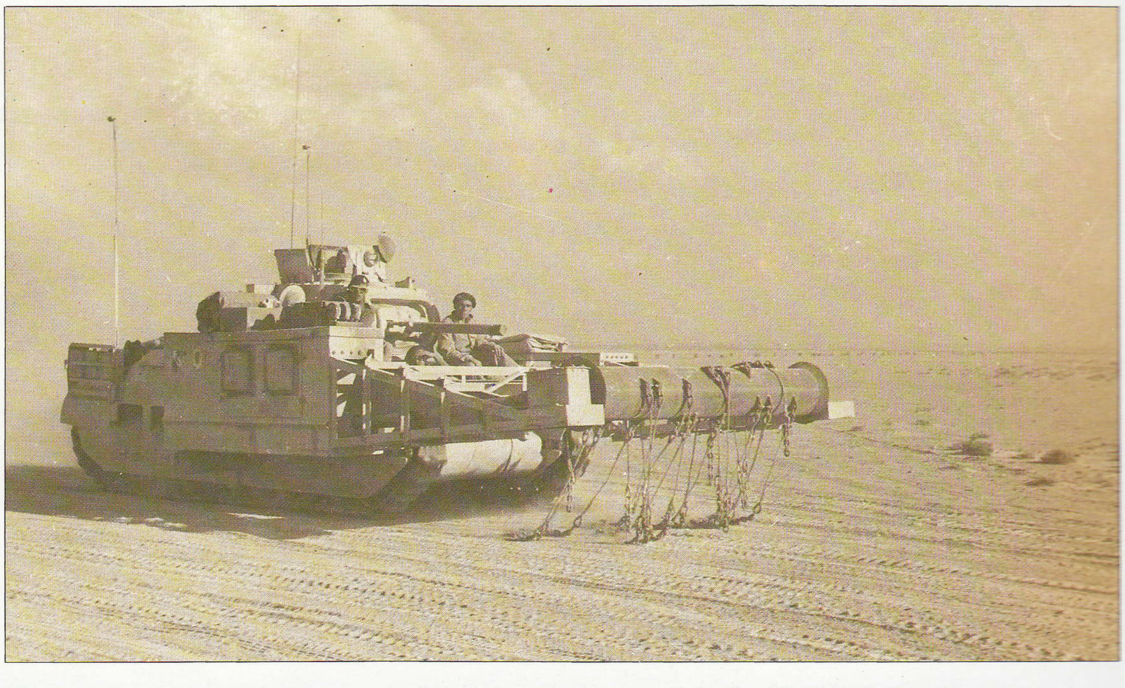
Perhaps the smallest of the Bangalore-type devices was the **Flying Bangalore**. This was used on Shermans fitted with CIRD rollers and was intended for barbed-wire clearing. Each of the CIRD arms carried a Bangalore Torpedo fitted with a rocket motor. The rockets carried the Bangalores across the wire and as they landed small grapnels held the torpedoes against the wire for exploding.

UK/SOUTH AFRICA

Mine-clearing flails

The Sherman Crab was the most widely-used mine flail tank of World War II. Although fitted to other types of tank, the Sherman was the preferred carrier. The odd-looking device at the hull rear is a station-keeping marker to guide other flail tanks.





The Matilda Scorpion prototype shown here was an early attempt to produce a mine flail tank. The main flail drum was driven by two 22.4-kW (30-hp) Bedford engines, one each side of the hull, and the device was later fitted to Valentine and Grant tanks as well as the Matilda.

The notion of using chain flails to detonate mines in the path of a tank came from a South African engineer, Major A.S.J. du Toit. The idea was that a horizontally-mounted drum carried on arms in front of a tank would be rotated under power. As it turned it would beat the ground in front with chains that carried weights on their ends, and this beating would provide enough pressure to set off any mines underneath. Early trials proved the effectiveness of the idea, and the first sets of mine flails were fitted to Matilda tanks in North Africa during 1942.

These first flails were known as **Scorpion**, and on the **Matilda Scorpion** the flail drum was powered by an auxiliary engine mounted on the right-hand side of the tank. These Scorpions were used during the El Alamein battle in October 1942 and also during some later North African actions. They proved to be so effective that a more specialized version, known as the **Matilda Baron** was developed. On the Baron the turret was removed and the flail drum was powered by two auxiliary engines, one on each side. However the Scorpion concept offered more long-term promise as it could be fitted to several types of tank to produce, for example, the **Grant Scorpion** and the **Valentine Scorpion**. But before that could happen a great deal of further development work had to be carried out, for the early flails had demonstrated some unwelcome traits. Among these were uneven beating patterns that left unbeaten patches, and flail chains that either became tangled and useless or simply beat themselves to pieces. Another problem became apparent on uneven ground, where the flails were unable to beat into sudden dips.

The development work carried out in the UK resulted in a device known as the **Crab** which was usually fitted to Sherman tanks to produce the **Sherman Crab**. The Crab had 43 chains mounted on a drum powered by a take-off from the main engine and had such features as side-mounted wire-cutting discs to hack through barbed-wire entanglements, screens to shield the front of the tank from flying dust and debris and, later in the Crab's development, a device to follow ground contours and enable the flail drum to rise and fall accordingly. Crabs were used by the 79th Armoured Division and later a number were handed over to the US Army for use in North West Europe. The main advantages of the Crab system were that it was very effective in its own right, and also permitted the carrier to retain its turret and main gun, enabling it to be used as a gun tank if the occasion arose.

Needless to say there were many other experimental models of mine flails. One was the **Lobster**, a device that came chronologically before the Crab but was not accepted for service. The **Pram Scorpion** was an off-shoot of the Scorpion with the drum drive coming from gears on the front sprockets of the carrier tank. Again, it was passed over in favour of the Crab.

The Americans did not spend much development time on mine flails. Instead they concentrated on anti-mine rollers and when they did require flails, as they did when they encountered the large defensive mine belts along the German borders in the winter of 1944-5, they used numbers of British Crabs which they redesignated the **Mine Exploder T4**.

The 'Funnies' in Action

An opposed landing on the French coast presented a host of engineering problems for the Allies, ranging from how to land tanks on a beach, how to pass safely through minefields and how to breach the huge seawalls. The British developed the 'funnies', a unique series of armoured vehicles designed to overcome all these obstacles.

To the rest of the British army the 79th Armoured Division were the 'Funnies', a name no doubt prompted by the odd appearance of some of their combat vehicles, and a name that stuck. To the men of the 79th Armoured Division the name was at first seen as anything but humorous, for they were hard at work attempting to formulate tactics and working methods in an area of warfare in which there was no previous experience. Everything they had to do had to be worked out from the beginnings, but they conquered the problems so well that their successes made them proud of their nickname.

The 79th Armoured Division was a very egalitarian formation. In the early days, when 'the book was still being written', everyone from troopers upwards was allowed his say in how things should be done. If anyone had a suggestion it was listened to, assessed and if suitable implemented. Thus by the time the 79th Armoured Division went into action for the first time, its operating methods were thoroughly understood at all levels and the standard of training had reached the pitch where things followed carefully rehearsed drills.

Sherman DDs

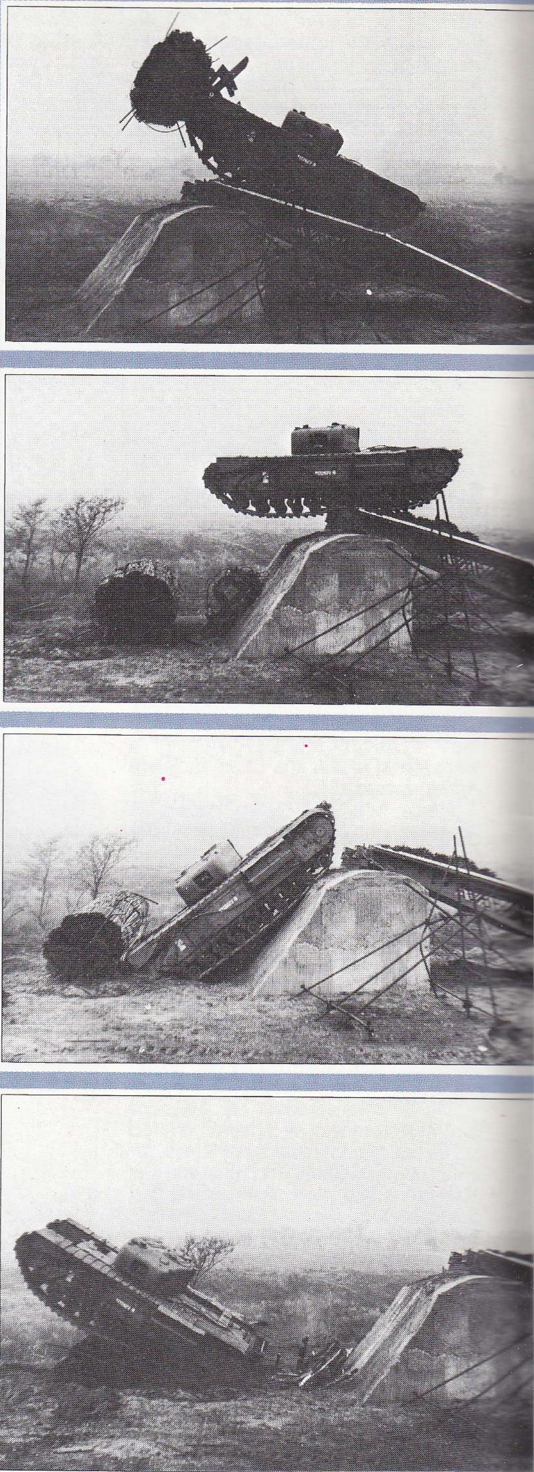
One of the first tenets of these drills was that the vehicles with their specialized tasks had to hit the beaches in a sequence. In practice this meant that the Duplex Drive (DD) Shermans had to swim ashore from the landing craft and arrive at the same time as the combat engineers in their AVREs. Once ashore the DD Shermans dropped their wading screens and were then ready to use their main 75-mm (2.95-in) guns to provide fire support for the AVREs. The DD tank gunners had been trained to the point where their gunnery was up to firing at the gun embrasures of the German beach defence weapons and hitting them within their first few shots. This was no easy task, especially as most of the German beach defence emplacements did not face out to sea. Instead they pointed along the beaches with the gun muzzles protected behind concrete walls on the seaward side. Thus the gun tanks had to move forward and expose themselves to the enemy gunners before they could even fire a shot. In places this meant that the AVREs had to go into action as soon as they landed just to clear obstacles on the path forward to where the Shermans could make their first shot. Of course in places the AVREs often used the Petard spigot mortars to knock out defence emplacements, but the Petard bombs, although large and powerful, were not very accurate and it usually took a direct hit on a gun barrel or embrasure to knock out the enemy gun, hence the need for the gun tanks.

Flail tanks

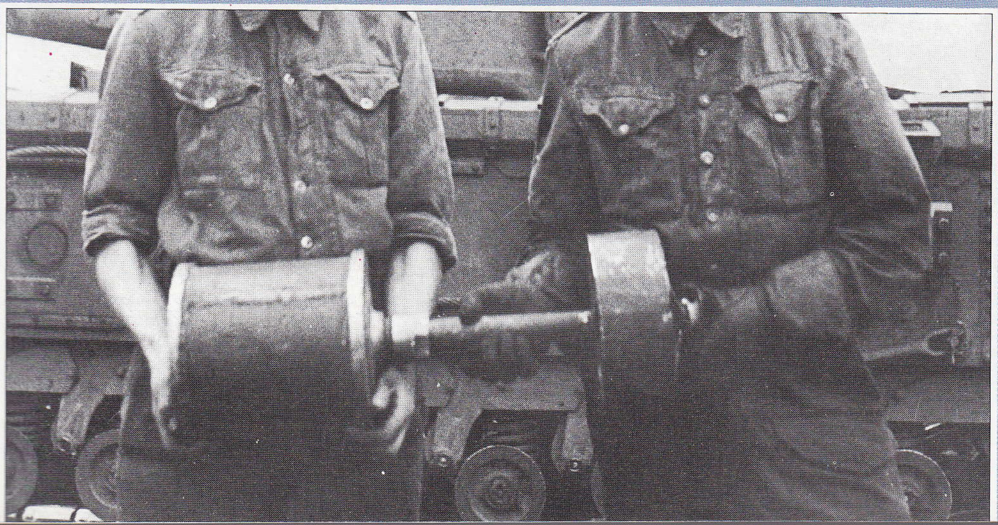
On the beach the gun tanks usually took up a position to provide covering fire as the AVREs and Crab flail tanks started their tasks. It was usually the Crabs that had to move forward first, for every beach and its immediate hinterland was liberally covered by minefields laid by the Germans in the months and years before the invasion. The Crabs usually operated in troops of four or five tanks, and had the task of clearing paths through the minefields on every battalion front, each battalion requiring at least two clear paths. The Crabs moved forward slowly to enable their flails to detonate every mine encountered: this meant speeds as low as 2.4 km/h (1.5 mph) and as the tanks moved their flails kicked up debris and dust that attracted the enemy's attentions. They also ploughed the ground up dreadfully, to the extent that they often had to be followed by AVREs with mat-laying devices to enable wheeled vehicles to cross the churned terrain.

The Crabs usually worked two or three abreast in an echelon formation. Every minefield they crossed and cleared was of course covered by some form of defence work or obstacle such as anti-tank walls, so covering fire had to be provided from the gun tanks at all times. On some beaches extra covering fire was provided by naval vessels offshore, fire orders and corrections being provided by Royal Artillery forward observation officers in gun tanks landed in the wave just behind the assault engineers, so the 79th Armoured Division did not always have to rely upon its own fire support resources.

In a typical case the Crabs would flail right up to the anti-tank wall and one would then flail a path to one side of the point where the obstacle was to be cleared. The Crabs then got out of the way for the AVREs to move in. Usually only one AVRE would approach the obstacle, equipped with one of the various forms of carrying frame such as the Jones Onion on which a heavy demolition charge had been placed. The frame would then be set against the obsta-



Above: One way of crossing a wall – the Churchill tank climbs a bridge laid by a second, bridge-laying tank, and perches precariously on top. It drops a bundle of fascines to the bottom, intending to drive over them. In the event, the fascines seem to have rolled on, but the Churchill gets down safely anyway.

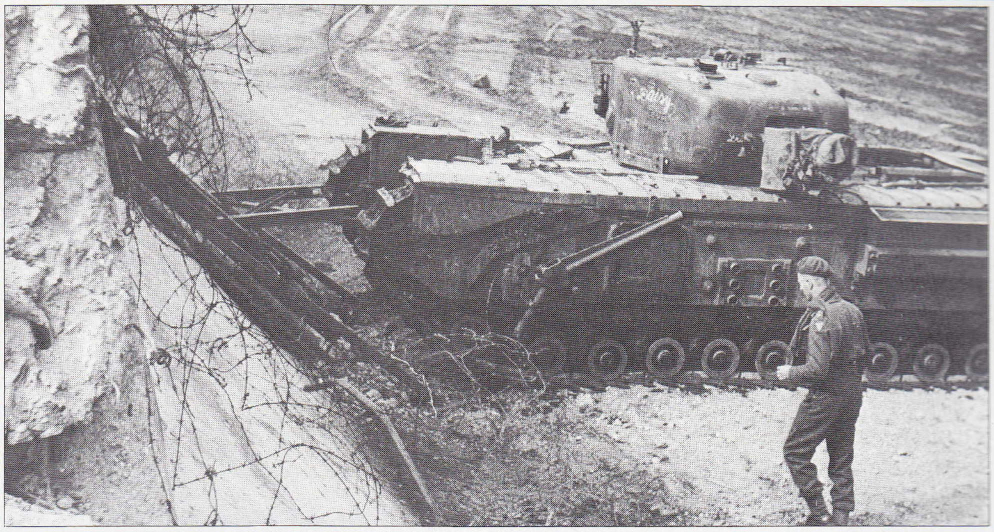


Left: The projectile fired by the Petard spigot mortar carried by the Churchill AVRE had a diameter of 290 mm (11.4 in) and weighed 18.1 kg (40 lb). It was known to the troops as the 'Flying Dustbin', and it could be fired to a range of about 73 m (80 yards).

cle and the AVRE would retire to the cleared area nearby. The charge would be detonated with a fearful roar, and more Crabs and AVREs would move forward. If all was well the charge would have blown a hole right through the obstacle but this was not always possible, so AVREs with various forms of assault bridging would be used to bridge the gap; in some cases one or other of the various forms of ARK would be used.

Sherman Crabs

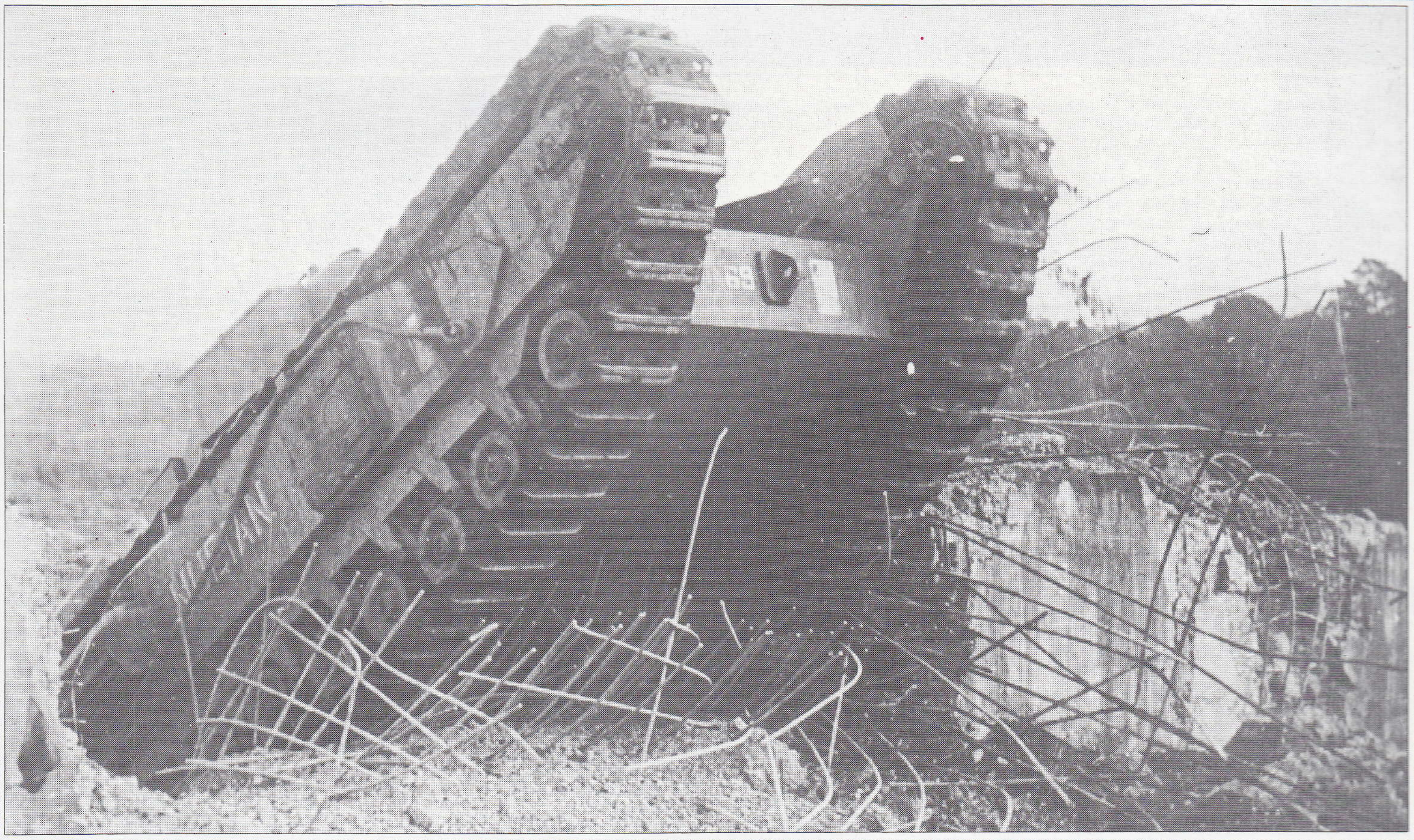
The beach in front of the obstacle could get rather crowded during this obstacle-busting stage. The Sherman Crabs, by the very nature of their task, were likely to become casualties at any stage; so two spare Crabs were usually held in reserve and they could always be called upon to use their guns for fire support or to provide local defence for the reserve AVREs that were also maintained to the rear of any action. Once the obstacle breach had been made there was a set drill for everyone to move forward, but this had to be done with care for it was known, thanks to the careful aerial and other reconnaissance, that the area behind the beach was the main German defence area covered with systems of bunkers, gun emplacements and tank traps. Thus the gun tanks once more provided the initial fire support as the AVREs and Crabs moved forward. By this time they would also have infantry support, for as soon as the beach was clear the Buffaloes with their troop cargoes could drive right up the cleared paths and close the defended area. AVREs with fascines could be used to cross the tank ditches and more assault bridging could be used to cross the water obstacles that the Germans were fond of providing along some of the flatter beach hinterlands.



Sappers train with a Churchill AVRE carrying a Goat Mark III demolition device. The Goat carried 816.5 kg (1800 lb) of explosive on a steel frame, which was positioned against an obstacle (here an anti-tank wall) and then released. The AVRE then backed off and set off the Goat charge by electrical or other means.

In places the German bunkers were difficult to knock out by gunfire or Petard bombs. Some were built very low on the ground and their weapon embrasures were difficult even to spot, let alone to hit. For these the 79th Armoured Division had a nasty solution, for the Crocodile tanks were brought up to deal with them. The Crocodiles were Churchill tanks with a flame projector mounted in place of the hull machine-gun and fuel for the projector in a trailer towed behind the tank. The flame projector could fire a jet of flame up to 110 m (120 yards) under favourable conditions, but for most purposes 73 m (80 yards) was the norm. The flame could be projected in one-second bursts or in longer-period bursts, and both could rapidly persuade the occupants of any bunker not to continue fighting.

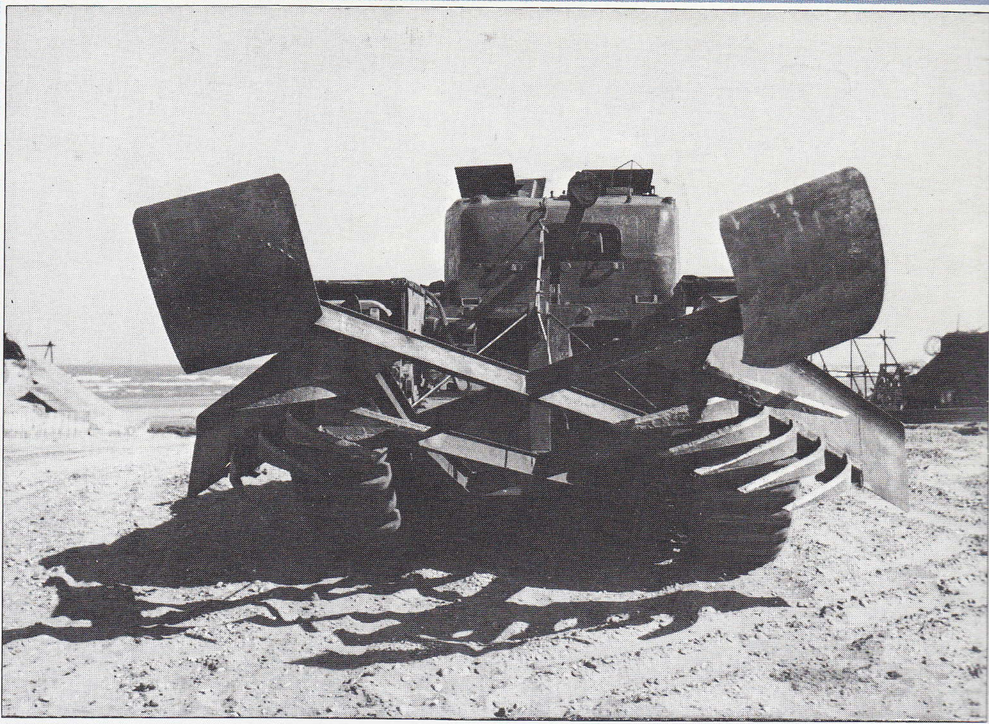
A Churchill advances through the gap in an anti-tank wall made by the detonation of a Goat Mark III demolition charge. Although the concrete has been almost entirely blasted away the steel reinforcing rods set into the concrete have survived, but as seen here they would soon be crushed flat and would present no obstacle to a tank.



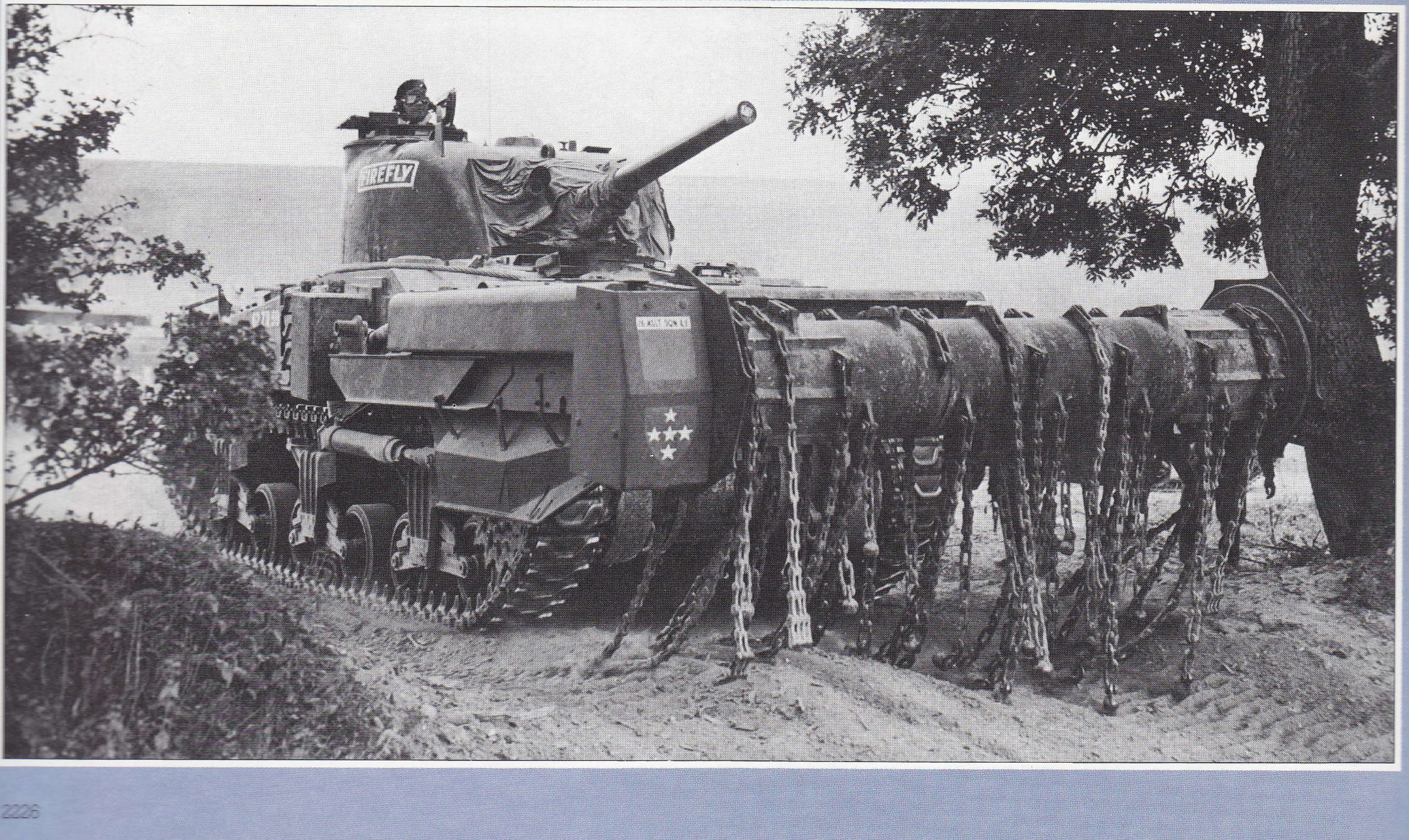
The 'Funnies' in Action

In the days immediately after the Normandy landings it was the Crocodiles that highlighted one of the 79th Armoured Division's greatest operational problems, that of command and control. Although the units of the 79th Armoured Division were split up among all the invasion units of the British and Canadian armies, they were still under the command and control of the 79th's divisional staffs. The problem was that local commanders did not always see things that way and often looked upon the 'Funnies' as things that they could use for their own local purposes. In many cases this was no problem, for the division was there to provide support and the troopers were usually willing to help. The problem was that the 79th Armoured Division appreciated the peculiar requirements of its equipment while others did not. AVREs were looked upon as gun tanks despite the limitations of their Petard mortars and some local commanders attempted to use them accordingly. The Crocodiles were another source of problems: the flame projectors used a pressure system for their fuel, and despite constant maintenance this was prone to leaks if it was kept in use for too long or at too high a pressure. The 79th Armoured Division knew this and devised drills and procedures to enable the Crocodiles to 'come up to steam' only just before they were needed. Local commanders could not appreciate this and attempted to keep Crocodiles on hand at all times ready for use at short notice. The result was that when they were needed their systems had often broken down or operated at too low a pressure.

In the days immediately after the landings the staffs of the 79th Armoured Division did their best to round up their scattered men and equipment and bring them back under divisional control. This was no easy task as many commanders had soon learned that vehicles such as the Crabs and the AVREs were invaluable on the battlefield. So well was this lesson learned that after 1945 the 79th Armoured Division somehow managed to survive all the post-war upheavals and reorganization so that its skills survived. Today the British army still has armoured engineers, but their strength is now down to a single three-squadron regiment. These still carry out an operational role very similar to that of the old 79th Armoured Division, but they are no longer known as the 'Funnies': today they are nicknamed the 'Armoured Farmers'.



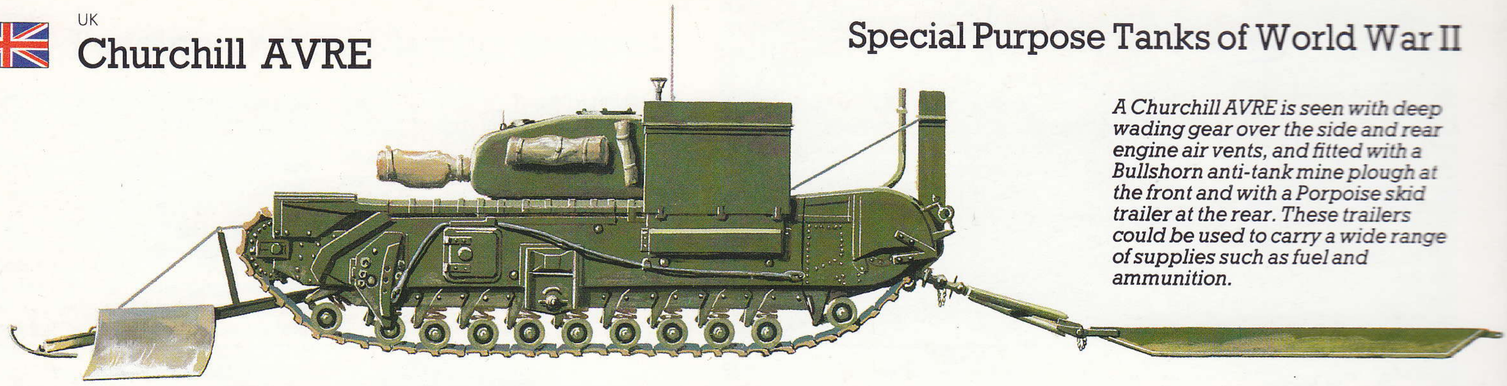
This odd-looking device was known as the Bullshorn; it was a mine plough device developed by the 79th Armoured Division to clear anti-tank mines from the path of the carrier tank. Seen here in the travelling position, the Bullshorn was used operationally during the Normandy landings and after, but only in small numbers.



This Sherman Crab has its flail drum and chains in the lowered position ready to start. The Crab was the standard British mine clearing vehicle; not only were its flails highly efficient, but they were so arranged that the carrier Sherman tank could retain its main 75-mm (2.95-in) gun.

UK

Churchill AVRE



A Churchill AVRE is seen with deep wading gear over the side and rear engine air vents, and fitted with a Bullshorn anti-tank mine plough at the front and with a Porpoise skid trailer at the rear. These trailers could be used to carry a wide range of supplies such as fuel and ammunition.

One of the hard lessons learned during the Dieppe raid of 1942 was that the Canadian engineers were unable to proceed with their obstacle demolitions and general beach-clearing because of a complete lack of cover from enemy fire. In the period after the raid a Canadian engineer officer put forward the idea of using a tank converted to the combat engineer role that could carry engineers to the point at which they had to operate, and be capable of carrying a heavy demolition weapon. This would enable the combat engineers to operate from under armoured cover and would also enable them to operate in close co-operation with armoured formations.

The idea was accepted, and after some deliberation the Churchill tank was selected as the basic vehicle for conversion. The task consisted mainly of completely stripping out the interior of the Churchill tank and removing the main armament. The interior was completely rearranged to provide stowage for the various items combat engineers have to use, such as demolition explosives, special tools, mines etc. The main turret was retained but in place of the normal gun a special device known as a Petard was fitted. This was a spigot mortar that fired a 290-mm (11.4-in) demolition charge known to the troops from its general shape as the 'Flying Dustbin'. The Petard projectile weighed 18.14 kg (40 lb) and could be fired to a range of 73 m (80 yards) to demolish structures such as pillboxes, bunkers and buildings. The Petard could be reloaded from within the vehicle.

The Churchill version was known as the **Churchill AVRE** (**Armoured Vehicle Royal Engineers**) and it quickly became the standard equipment of the armoured engineers attached to formations such as the 79th Armoured Division and the assault brigades, RE. As well as providing protection for combat engineers, the AVRE was soon in demand to carry all manner of special equipment.

The Churchill versions used for the AVRE were the Mk III and Mk IV. Many of the conversions were carried out using specially-produced kits, some by industry and some by REME workshops. The conversions included brackets and other attachment points around the hull to which items of specialized equipment could be fixed. A hook at the rear was used to tow a special AVRE sledge for carrying combat stores.

The AVREs were first used on a large scale during the Normandy landings of June 1944, where they excelled themselves to such an extent that the AVRE has been with the Royal Engineers ever since, the current in-service version being the Centurion Mk V AVRE. The Churchill AVRE remained in service until the mid-1950s and even later with some units. They were used to lay fascines, lay mats across soft ground, demolish strongpoints with their Petard mortars, bring forward combat engineering stores, place heavy demolition charges and generally make themselves useful.

The Churchill AVRE Mark II featured a fixed turret mounting a dummy gun. It could carry a front-mounted dismountable jib crane or a rear jib with a higher lift capacity. There was also a powerful front-mounted winch that could be used in conjunction with the jibs, and an earth anchor was mounted at the rear.

Specification

Churchill AVRE

Crew: 6

Weight: 38 tons

Powerplant: one Bedford Twin-Six petrol engine developing 261 kW (350 hp)

Dimensions: length 7.67 m (25 ft 2 in); width 3.25 m (10 ft 8 in); height 2.79 m (9 ft 2 in)

Performance: maximum road speed 24.9 km/h (15.5 mph); maximum road range 193 km (120 miles)

Armament: one Petard mortar, and one 7.92-mm (0.312-in) Besa machine-gun

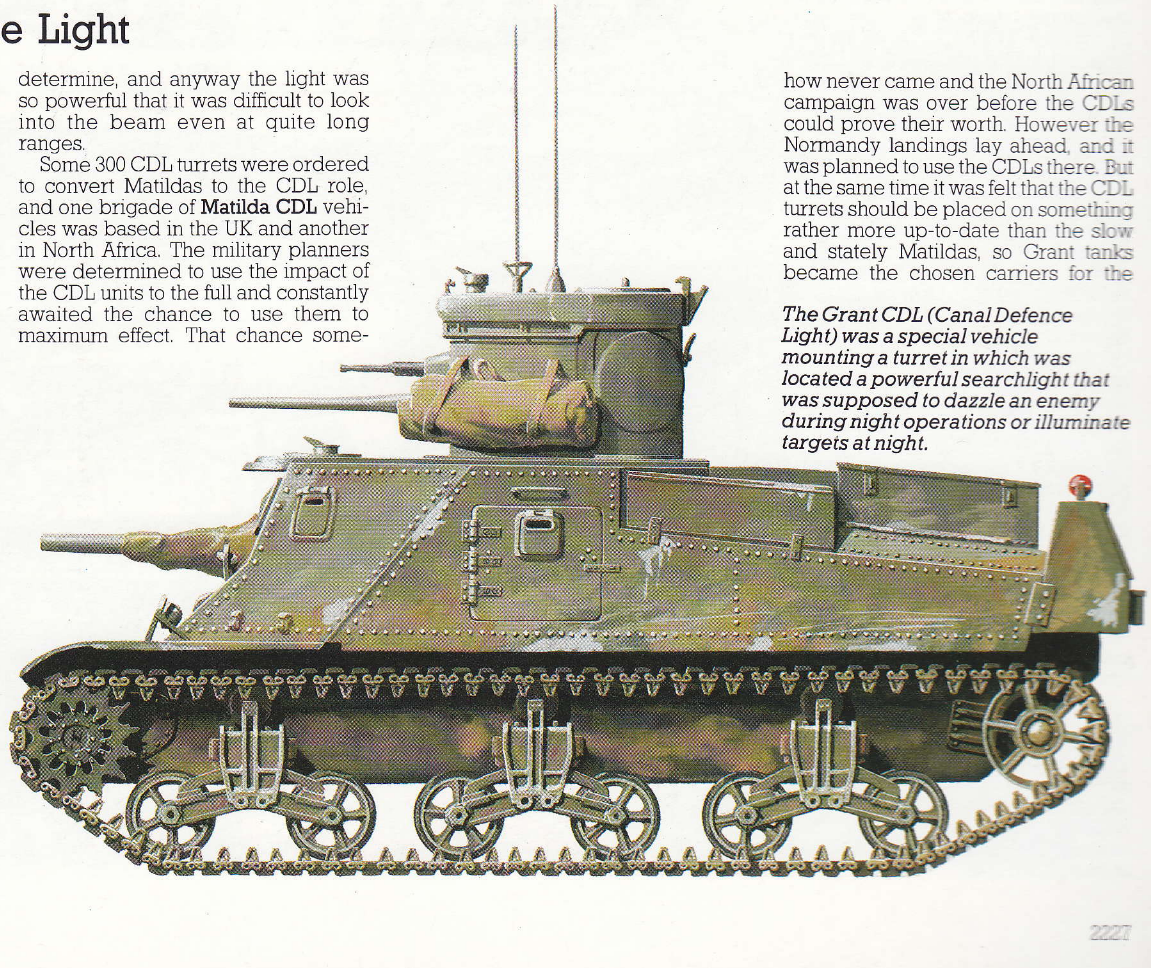
UK

Canal Defence Light

The device known under the cover name **Canal Defence Light** was one 'weapon' of World War II that was destined never to be used. In essence it was a simple idea, in which the normal gun turret of a tank was replaced with another housing an intense light to illuminate battlefields at night. All manner of tactical ploys were advocated for its use, ranging from simply blinding an enemy to providing general target illumination.

The idea of mounting powerful searchlights on tanks was first mooted during the mid-1930s by a group of interested civilians who 'sold' the idea to the War Office in 1937. The War Office carried out a series of development trials under conditions of great secrecy, and by late 1939 a turret was ready for production. The secrecy continued with the project being known as the Canal Defence Light, or **CDL**. The first turrets produced were for the Matilda II infantry tank, and all that the fitting of a CDL involved was the removal of the normal turret and its replacement by a new one, though changes had to be made to the Matilda's electrical systems as well. In the turret the searchlight was positioned behind a vertical slit in which was a shutter. In use the searchlight was switched on and the shutter was opened and closed very rapidly to provide a flickering impression to an observer in front. This flickering made the range of the CDL light difficult to determine, and anyway the light was so powerful that it was difficult to look into the beam even at quite long ranges.

Some 300 CDL turrets were ordered to convert Matildas to the CDL role, and one brigade of **Matilda CDL** vehicles was based in the UK and another in North Africa. The military planners were determined to use the impact of the CDL units to the full and constantly awaited the chance to use them to maximum effect. That chance somehow never came and the North African campaign was over before the CDLs could prove their worth. However the Normandy landings lay ahead, and it was planned to use the CDLs there. But at the same time it was felt that the CDL turrets should be placed on something rather more up-to-date than the slow and stately Matildas, so Grant tanks became the chosen carriers for the



The Grant CDL (Canal Defence Light) was a special vehicle mounting a turret in which was located a powerful searchlight that was supposed to dazzle an enemy during night operations or illuminate targets at night.

post-June 1944 campaigns. But once again the chance to use the **Grant CDL** in combat never arrived. Instead the CDLs were used for the relatively unexciting task of providing 'artificial moonlight' to illuminate the crossings of the Rhine and Elbe in early 1945.

Thus the CDL was carried throughout the war but never used. However, the idea certainly attracted attention. The US Army was most impressed by what it saw of the CDL at various demonstrations and decided to adopt the CDL for itself, and thus produced 355 CDL turrets for mounting on otherwise obsolete M3 Lee tanks. These were used to equip six tank battalions for special operations in Europe. The cover name **T10 Shop Tractor** was used for US CDL vehicles, but once again the CDL was destined not to be used in combat. As with the British the Americans awaited the right moment to use their lights and the war ended before that could happen.

Specification

Matilda CDL

Crew: 3 or 4

Weight: 26 tons

Powerplant: two Leyland E148/E149 diesel engines each developing 70.8 kW (95 hp)

Dimensions: length 5.61 m (18 ft 5 in); width 2.59 m (8 ft 6 in); height 2.51 m (8 ft 3 in)

Performance: maximum road speed 24 km/h (15 mph); maximum road range 257 km (160 miles)

Armament: one 7.92-mm (0.312-in) Besa machine-gun

UK

ARK

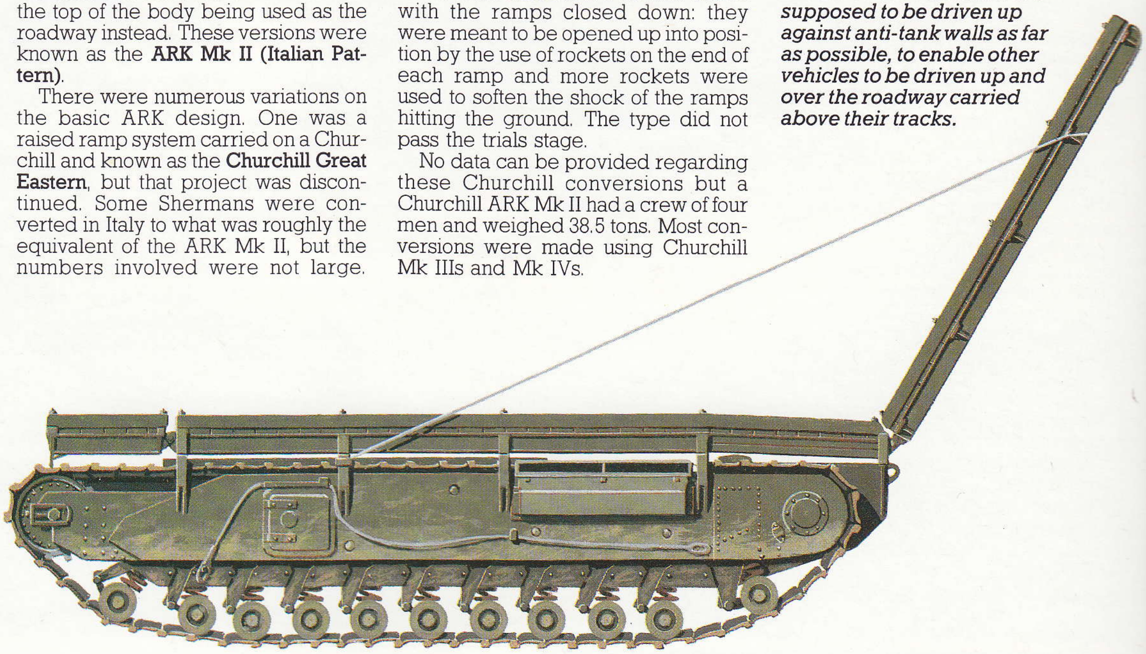
The **ARK** bridging tanks were only one type of armoured bridging vehicles used by the Allies during World War II. The British army had for long had an interest in producing bridging tanks and actually produced its first such equipment during the latter stages of World War I. In the years just before World War II it carried out a great deal of experimental work and one of its main achievements was a scissors-type bridge carried on and laid by a Covenanter tank. However, during the early war years this work had to be put aside in favour of more pressing things until the 1942 Dieppe landing emphasized the need for armoured bridging vehicles, not only to cross wet or dry gaps, but to enable other vehicles to cross obstacles such as sea walls.

It was the 79th Armoured Division that produced the first ARK (**Armoured Ramp Carrier**) in late 1943. Known as the **ARK Mk I**, this was a conversion of a Churchill tank with the turret removed and a blanking plate (with an access hatch in the centre) welded over the turret aperture. Over the tracks were placed two timbered trackways carried on a new superstructure and in front, in line with the trackways, were two ramps, each 1.05 m (3 ft 5.25 in) long. At the rear were two more ramps, each 1.72 m (5 ft 8 in) long. In use the ARK I was driven up to an obstacle such as a sea wall and pushed up the obstacle as far as possible. The front and rear ramps were then lowered from their travelling positions and other vehicles could then use the ARK to cross the obstacle. The ARK could also be driven into a wet or dry obstacle to act as a bridge.

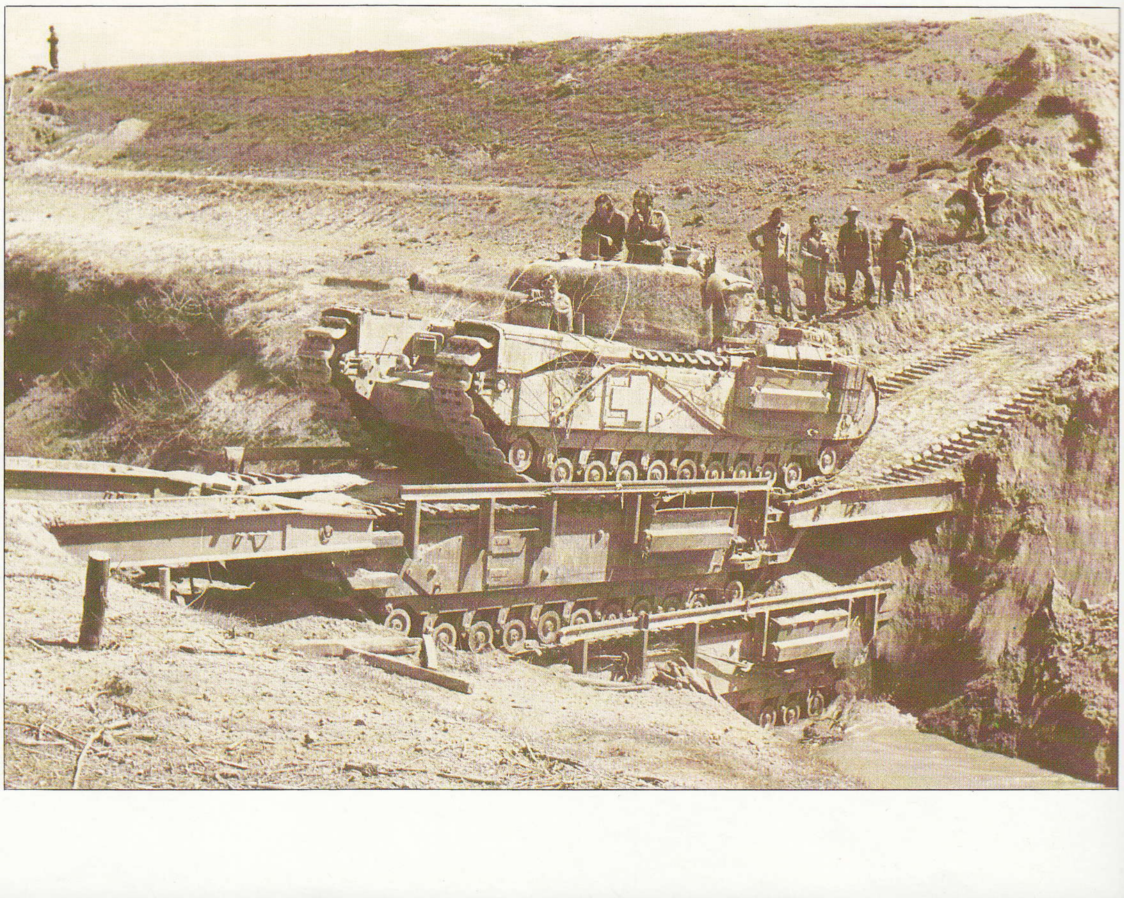
The ARK Mk I was soon supplemented by the **ARK Mk II**. Again this used a Churchill tank as the basis, and the same superstructure/ramp layout was used. But the Mk II used much longer ramps (3.8 m/12 ft 6 in) at both ends, and the right-hand set of trackways and ramps was half the width of the other (0.61 m/2 ft) as opposed to 1.213 m (4 ft). This enabled a much wider range of vehicles to use the ARK. In use the ramps were set up front and rear and held in the travelling position by cables and chains connected to front and rear kingposts. When the ARK came to a gap it drove into it and then released the cables to allow the ramps to drop. Other vehicles could then cross the ARK Bridge. The 8th Army in Italy produced its own ARK Mk IIs, but made them much simpler by omitting the trackways over the Churchill tank, the tank tracks and the top of the body being used as the roadway instead. These versions were known as the **ARK Mk II (Italian Pattern)**.

There were numerous variations on the basic ARK design. One was a raised ramp system carried on a Churchill and known as the **Churchill Great Eastern**, but that project was discontinued. Some Shermans were converted in Italy to what was roughly the equivalent of the ARK Mk II, but the numbers involved were not large. Another system, known as the **Churchill Woodlark**, was generally similar to the ARK Mk II but went into action with the ramps closed down: they were meant to be opened up into position by the use of rockets on the end of each ramp and more rockets were used to soften the shock of the ramps hitting the ground. The type did not pass the trials stage.

No data can be provided regarding these Churchill conversions but a Churchill ARK Mk II had a crew of four men and weighed 38.5 tons. Most conversions were made using Churchill Mk IIIs and Mk IVs.



A Churchill ARK Mk I is shown with its approach ramp raised. These vehicles were supposed to be driven up against anti-tank walls as far as possible, to enable other vehicles to be driven up and over the roadway carried above their tracks.



Two ARK Mk IIs are used to allow other vehicles to cross a deep ravine. The first ARK was driven into the ravine and the second ARK was then driven onto it, after which its ramps were lowered to form a bridge. The ravine was formed by the River Senio in Italy, April 1945.

UK

Fascine and mat-laying devices

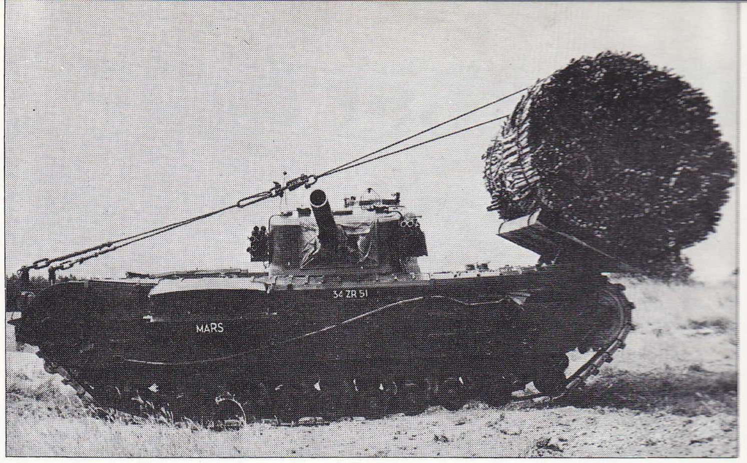
The **fascine** is an item of combat engineering equipment that dates back to ancient times, and for armoured warfare the type was resurrected during World War I to be dropped by tanks taking part in the Battle of Cambrai. At that time they were used traditionally, being dropped into trenches to allow other tanks to cross, and they were used for the same purpose during World War II. The advantage of the fascine for the combat engineer is that he can make them on the spot when they are required. The usual method was to cut brushwood and tie it into large bundles 3.35 m (11 ft) long. These bundles were tied into rolls between 1.83 m (6 ft) and 2.44 m (8 ft) in diameter and pulled onto wooden or steel cradles on the front of the tank. They were then held in place by cables that could be released from within the carrier tank. The main disadvantage was that the fascines usually restricted the driver's vision so that a crew member had to position himself to give driving instructions. Attempts were made to use periscopes to overcome this drawback but in the end the solution was found by redesigning the form of fascine cradle.

A type of fascine could also be used to make an assault roadway over soft or rough ground. This was formed by rolling up lengths of chespaling joined together by wire, rather like a length of fencing. A Churchill AVRE would carry this roll into position, where one end of the roll could be placed under the front tracks. As the AVRE moved forward it unrolled the mat and rolled over it to allow other vehicles to use the rough roadway so formed. Rolls of up to 30.5 m (100 ft) could be laid using this method, and more durable roadways could be produced by using a similar arrangement involving logs tied together (**Log Carpet**).

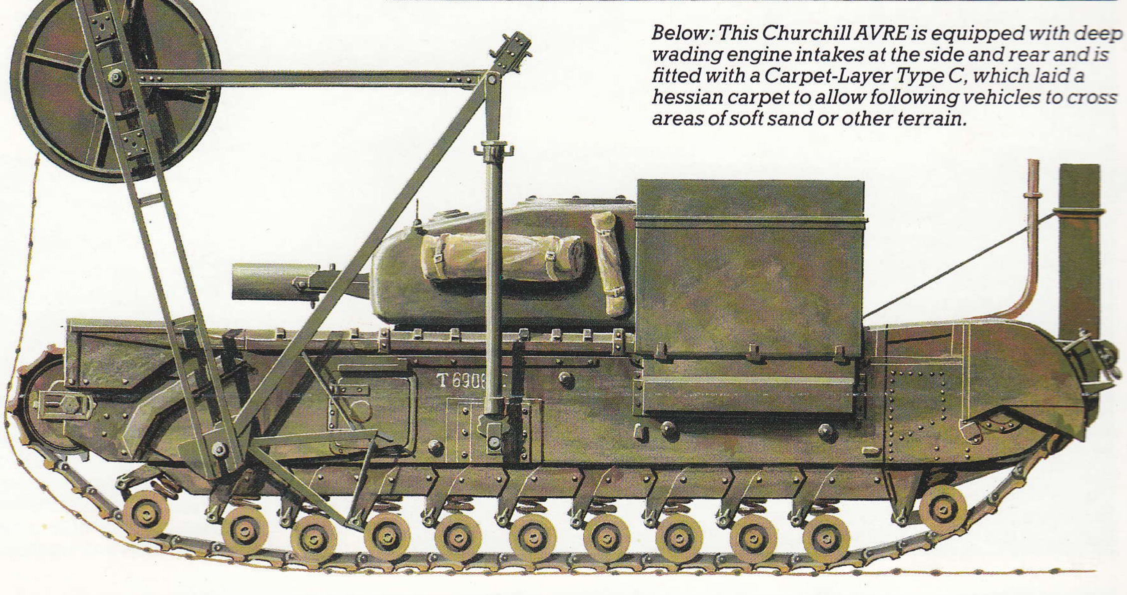
These chespaling or log roadways were intended for heavy use, but for assault purposes hessian mats were also employed. These mats were carried in front of a Churchill AVRE on bobbins held by side arms or (on one model) above a **Churchill AVRE Carpetlayer** turret. There were two main types: the **Bobbin Carpet** unrolled a hessian mat reinforced by chespaling at intervals that was wide enough to cover the full width of a tank; the other was only wide enough to cover a track width. Both were intended to cover wire obstacles to allow foot soldiers or wheeled vehicles to cross and the first of them was used during the Dieppe raid of 1942. On all types the bobbin could be jettisoned once it was empty or in an emergency.

Most of these fascine- or mat-laying devices were carried on Churchill AVREs, but Shermans were also used. In fact a special fascine carrier, known as the **Crib**, was developed for the Sherman. This was a special carrier frame that could be tilted forward to drop a fascine or a log mat. Some 'war weary' Shermans even had their turrets removed to allow them to be used as full-time fascine carriers.

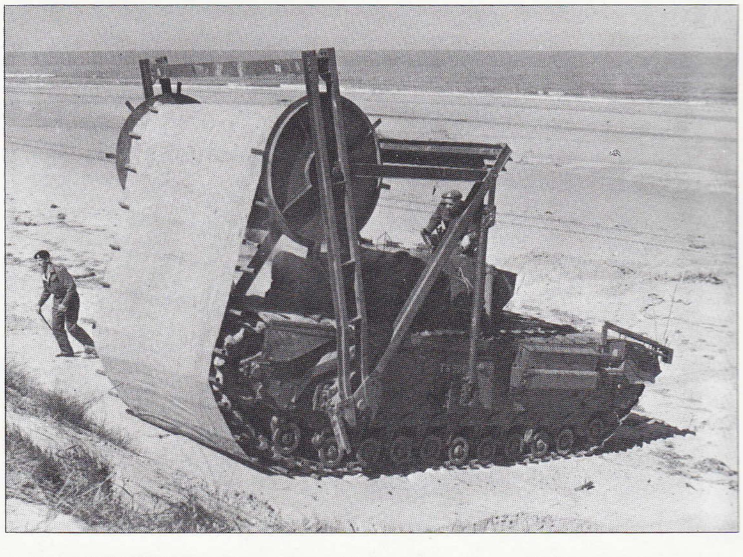
It should be stressed that the mat-laying devices, both hessian or timber, were meant for short-term use only. Prolonged use by heavy or tracked vehicles soon broke them up or simply tore them to pieces so they were usually used for assault purposes only or during amphibious landings to cover soft ground. It was not until well after World War II that flexible metal roadways were developed to replace the earlier devices.



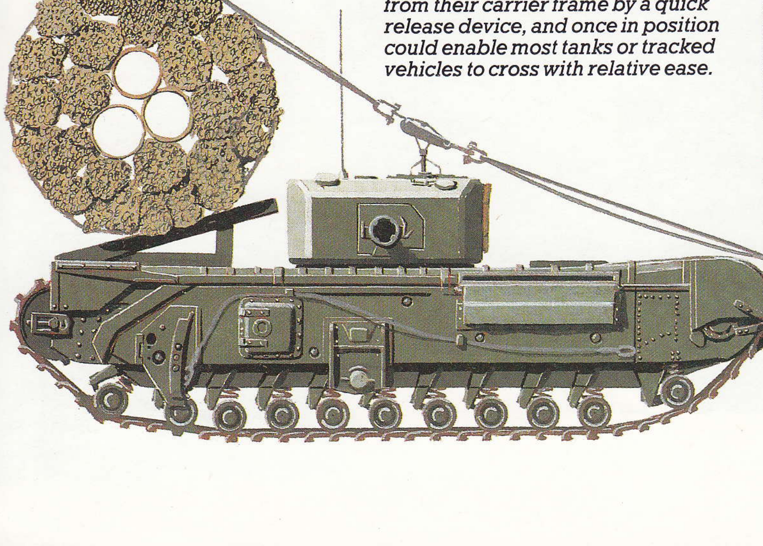
Right: This post-war Churchill AVRE has an early Centurion-style turret equipped with smoke dischargers. The cargo remains much as it would have looked in 1944, or 1917 for that matter, and the restrictions the fascine places on the driver's field of vision are obvious.

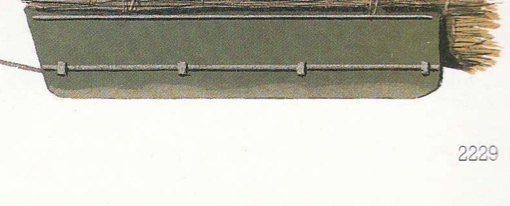


Below: This Churchill AVRE is equipped with deep wading engine intakes at the side and rear and is fitted with a Carpet-Layer Type C, which laid a hessian carpet to allow following vehicles to cross areas of soft sand or other terrain.



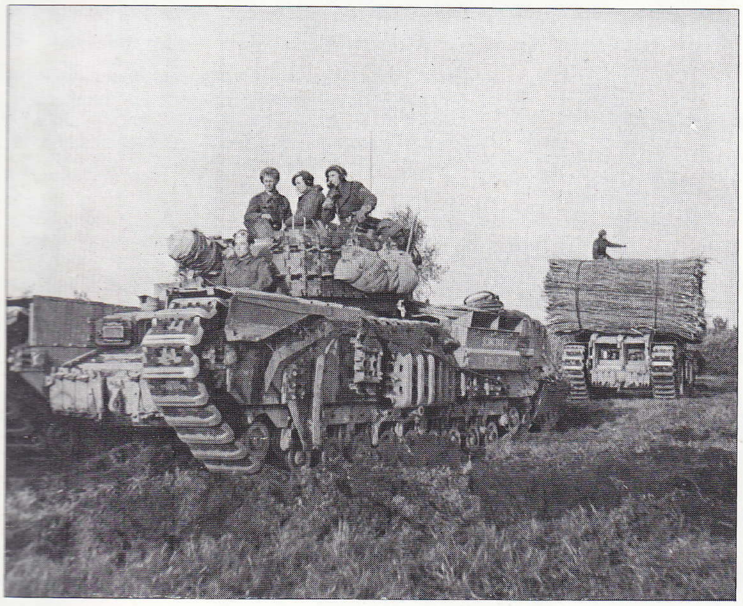
A Churchill AVRE operates a Carpet-Layer Type C, used to lay a continuous hessian mat over rough or soft ground to enable other wheeled or tracked vehicles to follow. These devices were used to cross the sand on some of the Normandy beaches on 6 June 1944.





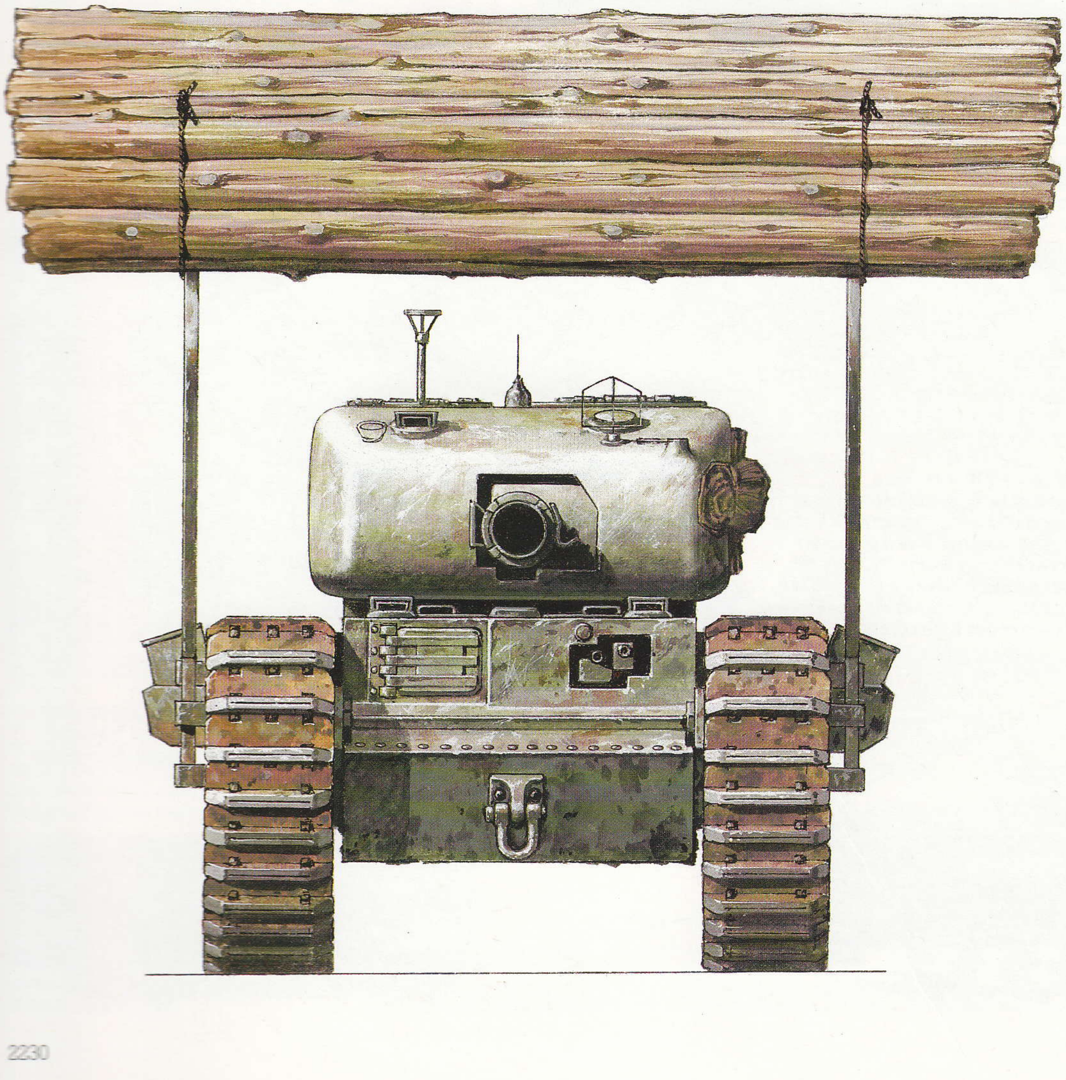
A Churchill AVRE carries a brushwood fascine at the front and tows another fascine on an AVRE skid trailer. The fascines were released from their carrier frame by a quick release device, and once in position could enable most tanks or tracked vehicles to cross with relative ease.

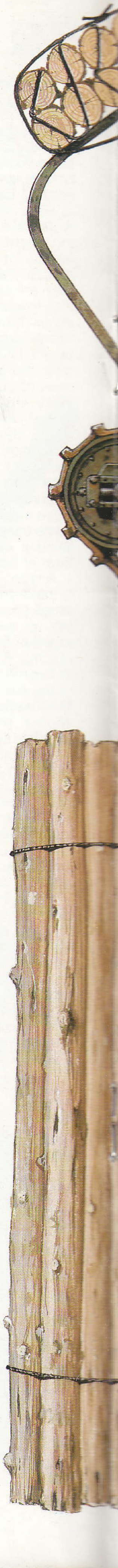
Churchill AVRE with Log Carpet

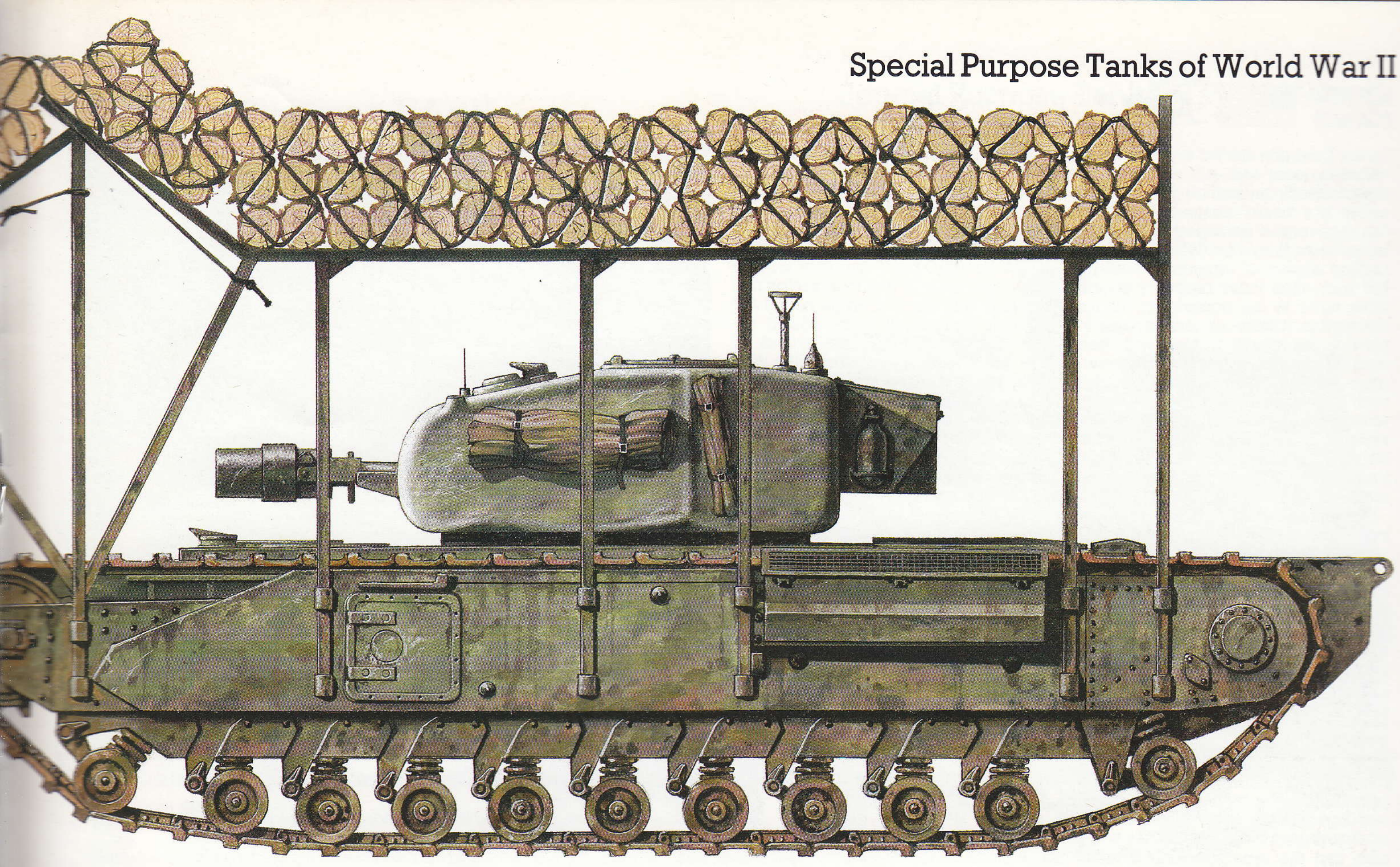


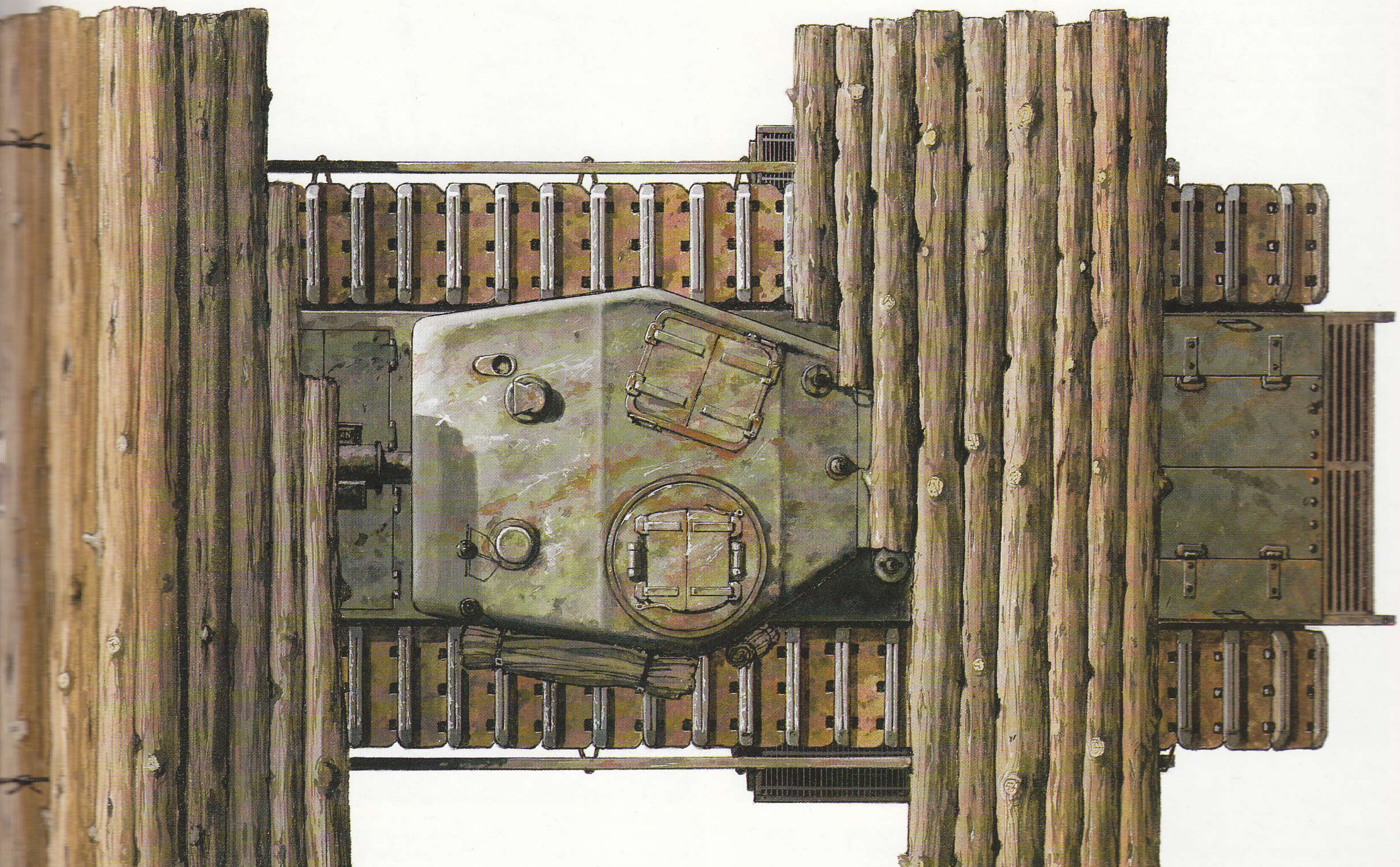
Left: A Churchill AVRE leads another carrying a large bundle of fascines during pre-invasion manoeuvres in 1944. Fascines tended to block the driver's line of sight from the vehicle, and here the fascine-carrier has a crewman on top. Note the spare track around the turret side of the AVRE in the foreground.

Below and right: The Churchill AVRE (Armoured Vehicle Royal Engineers) was one of the most versatile British armoured fighting vehicles. It carried a Petard mortar that fired a demolition projectile known as the 'Flying Dustbin', but, more importantly, could carry a wide range of special combat engineering equipment. The AVRE shown here is carrying a Log Carpet device, used to lay a rough roadway over soft ground so that other vehicles could follow. The roadway was laid under the front tracks and was pulled from its carrying frame as the AVRE moved forward. The AVRE could carry many other similar devices such as assault bridges, demolition and mat laying equipment, bundles of fascines to lay in ditches or trenches, and various anti-mine systems.









UK/USA

ARV

To the front-line soldier every tank is a valuable asset and any damaged or disabled tank that can be got back into action is a viable weapon. Therefore the recovery of damaged or broken-down tanks from a battlefield is an important aspect of armoured warfare, but very often these recovery operations have to be undertaken under enemy fire. It therefore makes sense to provide the recovery crews with their own armoured vehicles and even more sense to provide these vehicles with mechanical handling devices, winches and other special recovery tools. Thus World War II saw the first large-scale use of recovery vehicles, and on the Allied side there were many different types.

Nearly all Allied **Armoured Recovery Vehicle** (**ARV**) types were conversions of existing tanks, usually models that were past their best and could be spared for the role. Nearly every type of Allied tank was used for the ARV role at some time or another but the main types involved on the British side were Crusader, Covenanter, Centaur, Cavalier, Cromwell, Ram and inevitably the Churchill. Most of these ARV conversions involved the removal of the turret (along with the main armament) and its replacement by either a fixed superstructure or an open compartment for the crew. Winches were installed and various forms of jib crane or sheerlegs were added. Many types also had the assistance of an earth spade to provide the winch with better purchase and thus extra pull. The British also made extensive use of turretless Shermans for the ARV role.

The American ARVs were generally more involved vehicles. They too were based on existing tank chassis, but the conversions were often carried out in factories rather than the base workshops of the other Allied armies (including the British) and thus more detail design care could be lavished upon the final product. A typical American product was the **Tank Recovery Vehicle M32**. On this the turret was fixed and a smoke-firing 81-mm (3.2-in) mortar was fitted. In the space normally taken up by the fighting compartment was placed a powerful 27216-kg (60,000-lb) capacity winch, and an A-frame jib was mounted on the forward hull. Extra stowage points for special equipment were added all over the hull. Several sub-variants of the M32 were produced. The M3 medium tank series was also used to produce the **Tank Recovery Vehicle M31** with a jib crane over the rear of the hull. The British also made their own conversion of the M3 Grant by removing all the armament and installing a winch in the main compartment.

The American ARVs were produced in large numbers, so large in fact that some of the M32s could be converted as artillery tractors. But one factor that both British and American ARVs had in common and that was that none of them matched the power of the German Bergepanther. The Bergepanther remained the most powerful ARV of World War II as far as operational models were concerned, but the Allied ARVs could still tackle most recovery tasks without difficulty, for they did not have to cope with the Tigers and Panthers of the German army.

Specification

Churchill ARV Mk II

Crew: 5 or 6

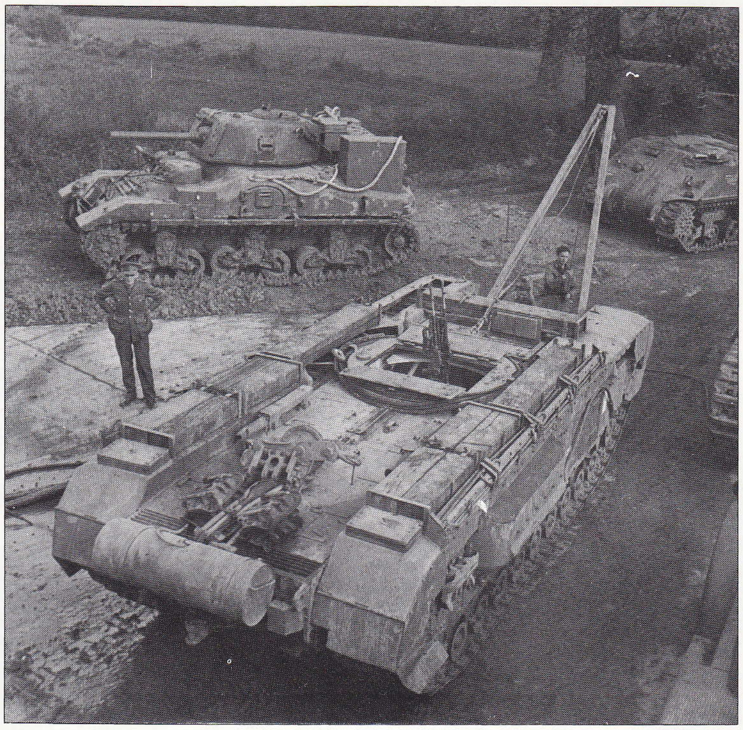
Weight: 40 tons

Powerplant: one Bedford Twin-Six petrol engine developing 261 kW (350 hp)

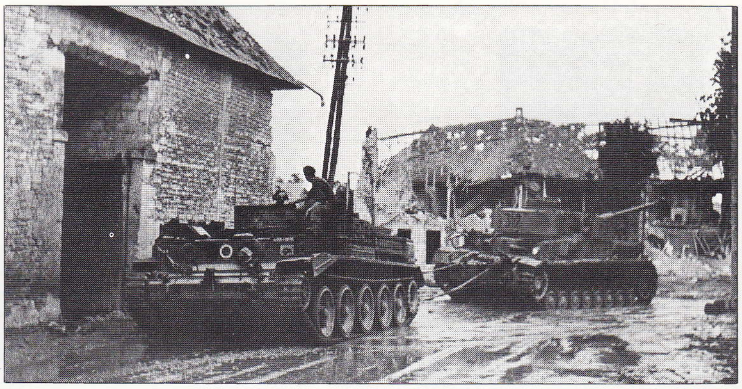
Dimensions: length 8.28 m (27 ft 2 in); width 3.35 m (11 ft); height 3.02 m (9 ft 11 in)

Performance: maximum road speed 24.9 km/h (15.5 mph); maximum road range 193 km (120 miles)

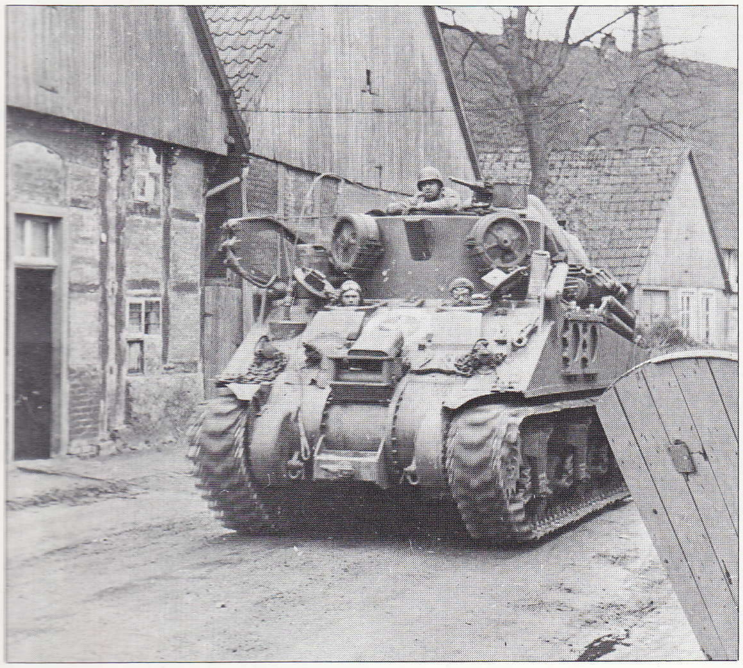
Armament: one or two machine-guns



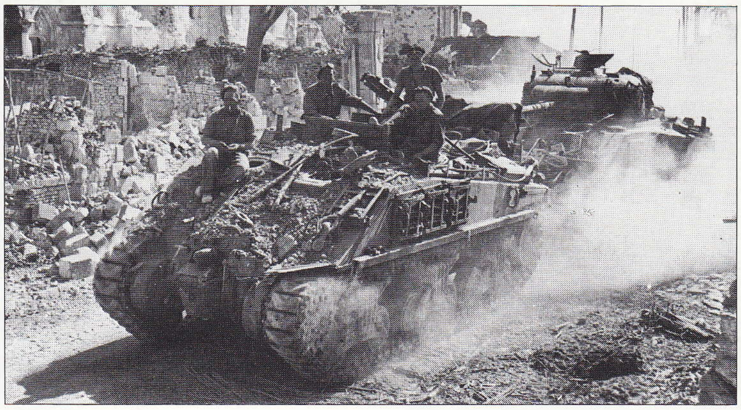
A Churchill ARV (Armoured Recovery Vehicle) Mk I has its front jib erected and twin 7.7-mm (0.303-in) Bren machine-guns mounted in the hull. This vehicle had a crew of three and carried special tools and welding equiment for the recovery role. The vehicle was basically a turretless Churchill Mk IV.



A Cromwell ARV (Armoured Recovery Vehicle) is used to tow a captured German PzKPfw IV tank out of the way of other vehicles. The Cromwell ARV was a turretless conversion of an early mark of Cromwell tank that could be fitted with a jib crane and other gear.



An M32 Tank Recovery Vehicle rolls through a village in north west Europe, 1945. Based on the M4 tank hull, these vehicles were used from 1943 onwards and used a fixed superstructure in place of the M4 turret. A large winch was fitted along with other special recovery gear and tools.



A Sherman ARV Mk I tows a Sherman gun tank during the campaign in Normandy, June/July 1944. This ARV was a British conversion of a Sherman tank that involved removing the turret and fitting a front-mounted jib crane and other equipment.

UK/USA

Sherman BARV

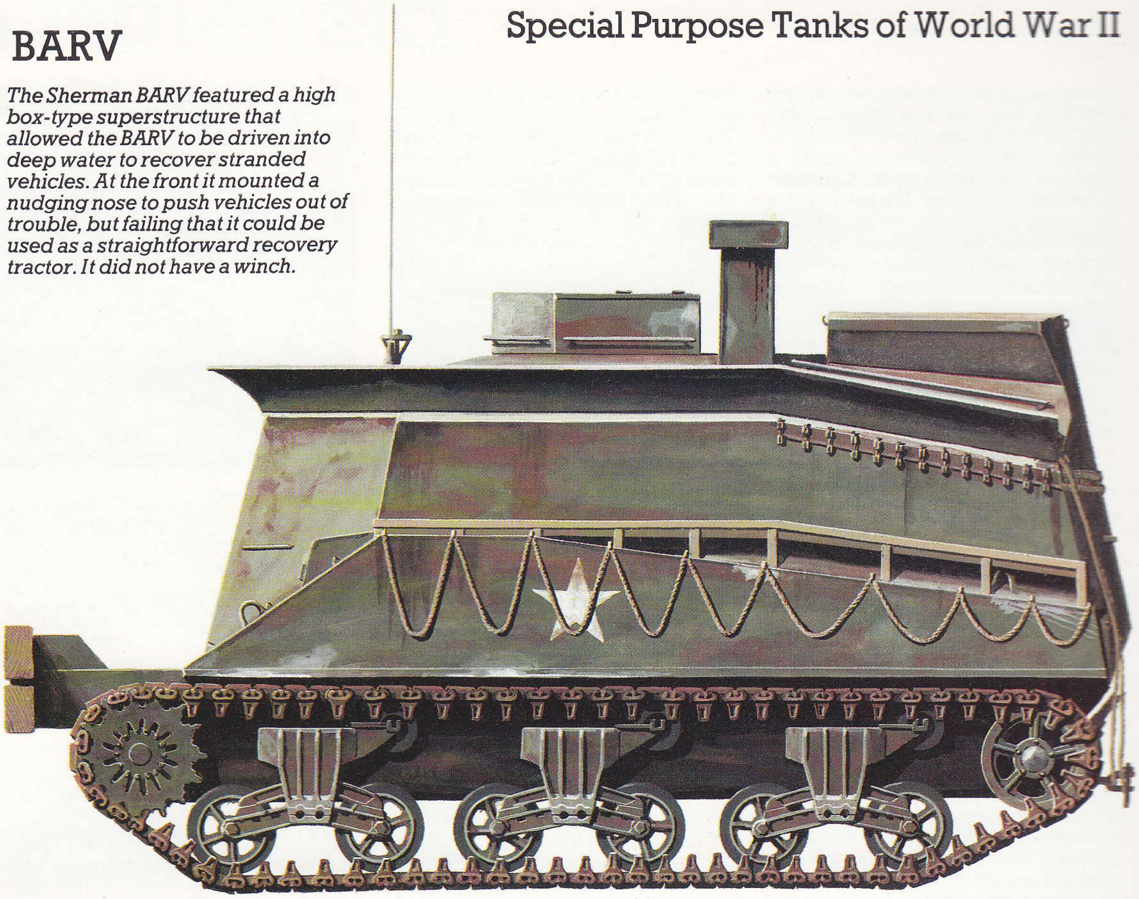
By late 1943 plans for the amphibious landings in northern France had reached the stage where it was decided to have deep-wading recovery vehicles on hand at the beaches to assist any vehicles that got bogged or broken down while still in the water. It was decided to convert Churchill and Sherman tanks for the role but the Churchill conversion did not get past the prototype stage and all work concentrated on the Sherman.

The result was known as the **Sherman Beach Armoured Recovery Vehicle** (**Sherman BARV**). It was little more than an ordinary Sherman with the turret replaced by a tall superstructure. This superstructure was open at the top and had plates that sloped to a boat bow profile at the front. The turret opening was closed off and all air intakes and cowls were extended upwards. Waterproofing was extensive and a bilge pump was added to the hull.

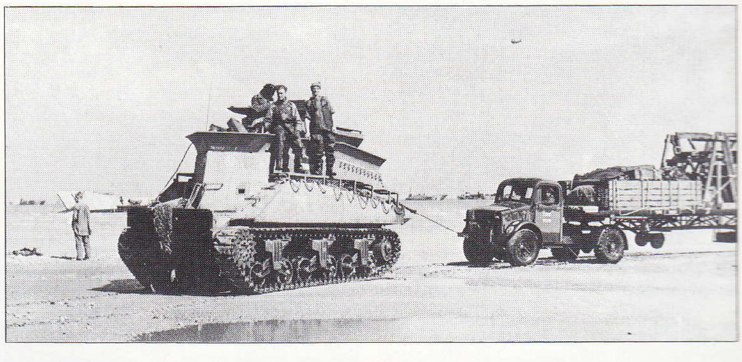
The first BARV was ready for trials in December 1943 and these trials proved to be so successful that a request for 50 conversions (later increased to 66) was made immediately. By the time the D-Day landings were made in Normandy there were 52 BARVs ready to hand, and one of them was actually the first armoured vehicle to touch down on the beaches. They had plenty to do for the weather on D-Day was rough, to the extent that many armoured and other vehicles were swamped as they made their way from the landing craft to the safety of the beaches. The BARV was thus used as a towing vehicle to get them ashore. It could tow only, for in the haste to produce the BARVs it was decided to omit the usual winches. In their place some measure of assistance to stranded vehicles could be provided by nudging them with baulks of timber secured to the BARV nose. These nudgers could be used not only for vehicles but with small landing craft that got themselves stuck on the beaches.

The BARVs could operate in up to 3.05 m (10 ft) of water, depending on weather conditions, and often took on a nautical air enhanced by the use of lifelines fixed around the upper superstructure. Many BARV crews included a diver in their number and life jackets were frequently worn. The BARVs were a REME responsibility as they were primarily recovery vehicles. The REME even had a hand in their production, for this corps supervised BARV production in two small Ministry of Supply workshops.

The BARVs went on to a long post-war service career during which they acquired the name **Sea Lion**. They were eventually replaced by the Centurion BARV which closely followed the general outlines of the Sherman BARV. Over the years the Sherman BARVs were gradually updated with better radios and such refinements as ropes to soften the impact of their 'nudgers', but they never acquired winches or any form of earth spade to enable increased-capacity pulls to be made.



The Sherman BARV featured a high box-type superstructure that allowed the BARV to be driven into deep water to recover stranded vehicles. At the front it mounted a nudging nose to push vehicles out of trouble, but failing that it could be used as a straightforward recovery tractor. It did not have a winch.



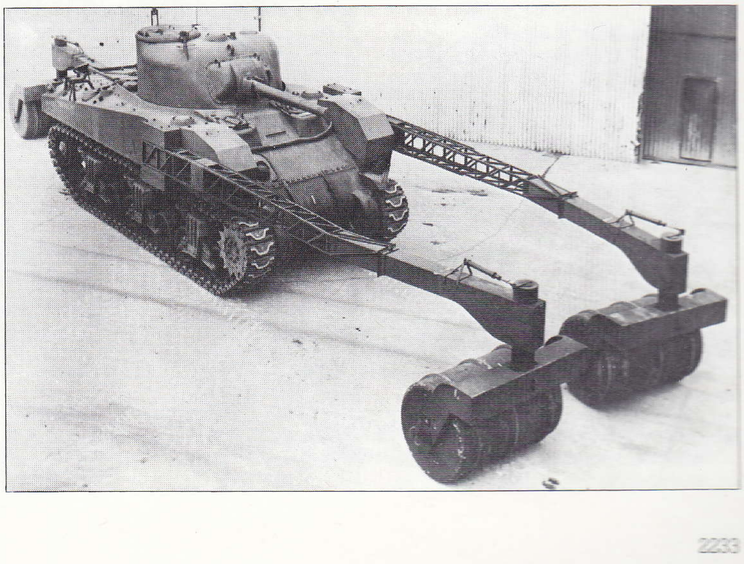
The Sherman BARV (Beach Armoured Recovery Vehicle) was developed during 1943 to tow bogged-down vehicles from deep water during amphibious operations. It was a tractor device only, and the crew usually included a trained diver to secure towing cables to stranded vehicles for towing.

UK/USA/CANADA

Mine-clearing rollers

The mine-clearing roller was one of the very first anti-land mine devices used with tanks and in theory rollers are among the simplest to use. They consist of a set of heavy rollers pushed ahead of the tank, their weight and pressure alone being sufficient to destroy the mines by setting them off in front of the tank. Translating this theory into practice should also have been simple but was not. The main problem was the weight and bulk of the rollers that had to be used: in order to make the rollers heavy enough they had also to be large, and this made them very difficult loads to handle using the average tank of the period. In fact some of them were so large and awkward to push that it sometimes took two tanks (the carrier tank plus another behind it to provide extra 'push') to move them forward. This two-tank arrangement was often necessary when rollers had to be pushed over soft or rough ground.

The British were probably the first to develop anti-mine rollers, and experimented with them in the years before World War II fitted to vehicles such as the Covenanter. They knew their first models as the **Fowler Roller** or the **Anti-Mine Roller Attachment** (**AMRA**). From these were developed the **Anti-Mine Reconnaissance Castor Roller** (**AMRCR**) system that was fitted to Churchills and British Shermans. These rollers used leaf springs to keep

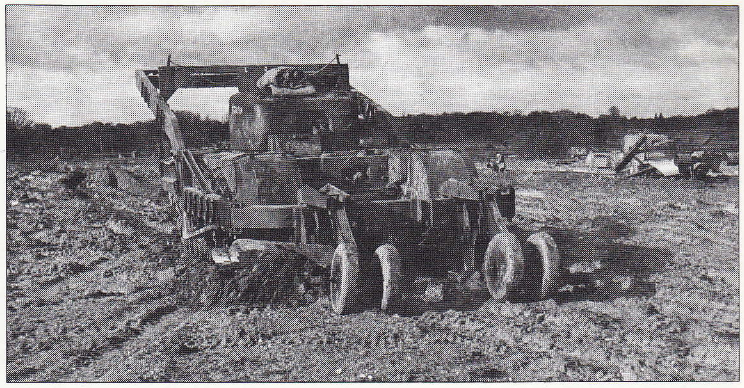


The Lulu roller device did not detonate mines by pressure, as the front rollers were only light wooden containers carrying electrical sensor devices to denote the presence of buried metal objects such as mines. Although it worked, the Lulu was too fragile for operational use.

the rollers in contact with the ground, but they were so cumbersome that they were not used operationally. A more successful design appeared in 1943 and was known as the **Canadian Indestructible Roller Device** (**CIRD**). This used two heavy armoured rollers mounted on side arms, and was so arranged that if a roller detonated a mine the resultant blast lifted the roller and a lever came into contact with the ground, the subsequent movement of the tank operating the lever to return the roller to the ground again for further use. CIRD was fitted to both Churchills and Shermans, but the system was not used in action.

The Americans also became involved with mine rollers and produced three main models. The first version was the **Mine Exploder T1** and was intended for use with M3 Lee tanks, but not many were made as these tanks had passed from front-line service by the time the rollers had been developed. From them evolved the **Mine Exploder T1E1** or **Earthworm**, but again this was devised for use by one vehicle only, in this case the M32 Tank Recovery Vehicle. For use with the M4 Shermans came the **Mine Exploder T1E3** (later the **Mine Exploder M1**) which was generally known as the **Aunt Jemima**. This used two very large sets of roller discs mounted on side arms in front of the carrier, and the system was used in action despite its great bulk and awkwardness. It proved to be successful enough, and was even developed into an **M1A1** version which was even heavier.

The Americans developed a whole string of other types of mine roller, few of which got past the experimental stage. Perhaps the oddest of them was the **Mine Exploder T10** on which the rollers became the road wheels for an M4 tank body, complete with gun turret. Two rollers were mounted forward and another set of roller discs was at the rear with the tank body slung between them. This device got no further than trials, and neither did the series of vehicles known as the **Mine Resistant Vehicle T15**. This was an M4 tank fitted with extra body and belly armour and intended to set off mines by simply driving over them, relying on its extra protection for survival. None of these vehicles was ready for use by the time the war ended, and work on the type then ceased.



Rollers were an apparently obvious solution to a minefield, but it proved exceedingly difficult to detonate enough mines by the rollers' weight alone. Solutions included rollers so heavy that it took several vehicles to move them, and plough and roller combinations.

UK/USA

Gun tractors

As a general rule most artillery tractors were specially developed for the task but some artillery weapons developed during the war years had to make do with what was to hand. In nearly every case this meant the conversion of an obsolete or obsolescent tracked vehicle, especially for the larger weapons. The use of tracked vehicles gave the gunners considerably more tactical mobility that could have been achieved by using wheeled tractors, but in general terms using tracked vehicles was expensive and it was a measure that was only bearable in wartime.

A typical use of an obsolete tank chassis can be seen with the British **Crusader Gun Tractor Mk I**. This was developed to tow the bulky 17-pdr anti-tank gun, and used the Crusader II tank chassis as the basis. Onto the chassis was built an open superstructure fitted out with seating for the gun crew and with ammunition lockers. These tractors were widely used by Royal Artillery anti-tank regiments serving with armoured divisions in Europe during 1944 and 1945, and proved to be well-liked and fast tractors capable of towing their 17-pdr guns almost anywhere. Some turretless Shermans were also used in this role.

The Crusader Gun Tractor was almost the only conversion of a tracked vehicle made by the British, but it was otherwise with the Americans. Their far more extensive automotive manufacturing resources enabled them to produce all manner of special artillery tractors, many of them based on existing vehicles. Typical of these was the **Full-track Prime Mover M34**, an odd vehicle, for it was an M32 Tank Recovery Vehicle stripped of its recovery kit and used as a tractor only. It was reserved for really large items of artillery such as the 240-mm (9.45-in) howitzer. Other attempts were made to convert old M2 Lee tanks for the tractor role, but they were not developed fully as special vehicles could be produced without difficulty.

There were two main types of tractor produced in the United States. One was the **High-Speed Tractor M4** and the other the **High-Speed Tractor M5**. The M4 used components of the M2A1 Lee tank allied to a new box-type body that could house the crew and a quantity of ammunition. Compared to other types of tractor the gun crew could travel in comfort as the cab was weatherproof and fitted with such luxuries as heaters, and yet there was still plenty of room for stowage. The M5 tractor was smaller and used components from the M3 light tank series. The crew accommodation was more open than that of the M4 but the tractor still had plenty of space and was equipped with such handy items as winches. The M4 was used to tow artillery up to 155 m (6.1 in) in calibre, and the M5 was used for artillery up to 203 mm (8 in) in calibre. Both types were produced in considerable numbers and many of both are in use to this day. Large numbers were handed out by the Americans to the Allied armed forces, and a few were used by the British before the war ended.

Specification

High-Speed Tractor M5

Crew: 9

Weight: 12837 kg (28,300 lb)

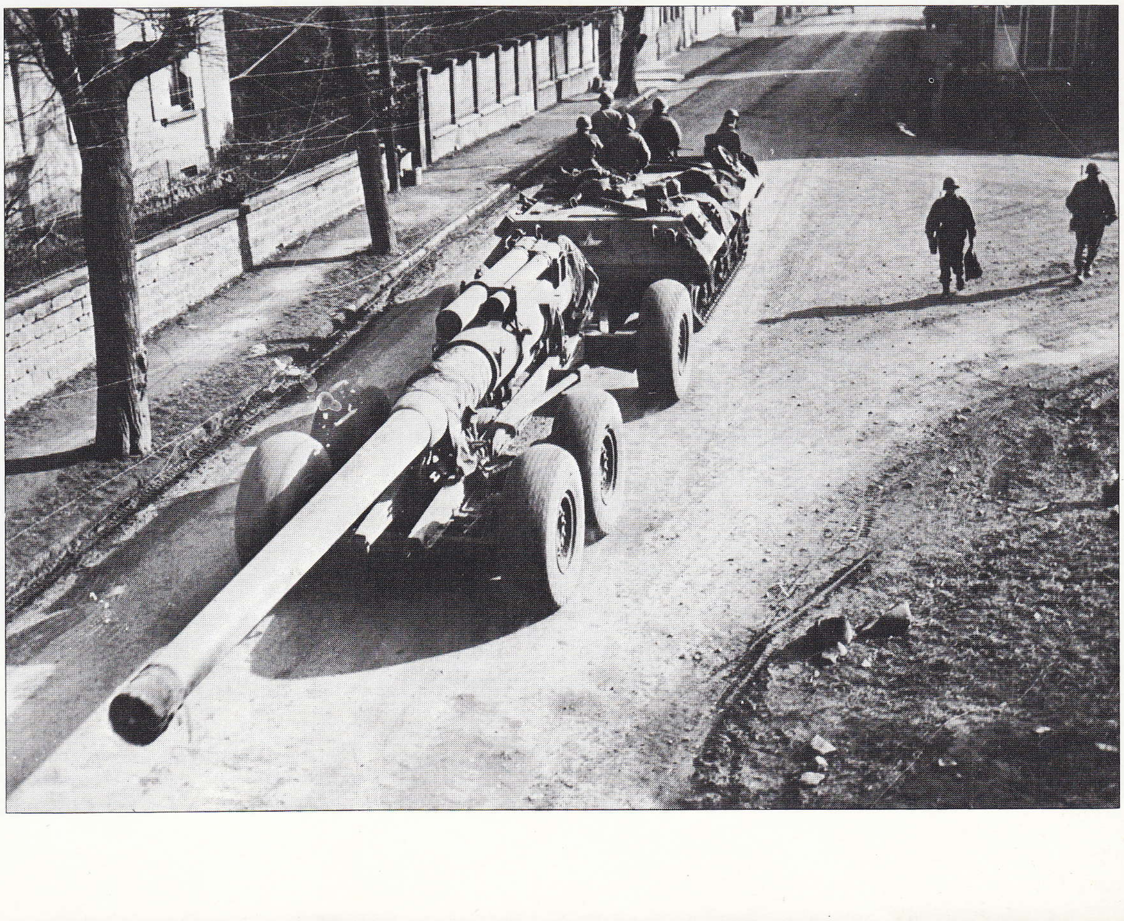
Powerplant: one Continental R-6572 petrol engine developing 175.2 kW (235 hp)

Dimensions: length 4.85 m (15 ft 11 in); width 2.54 m (8 ft 4 in); height 2.64 m (8 ft 8 in)

Performance: maximum towing speed 56.3 km/h (35 mph); maximum road range 241 km (150 miles)

Armament: none

The M35 Full Track Prime Mover was a turretless conversion of the M10A1 tank destroyer for use as a tractor for heavy artillery. This example is towing the barrel of a 203-mm (8-in) Gun M1 towards Germany in February 1945; the Carriage M2 would have been towed separately.



Over the Minefield

Perhaps the toughest combat engineer task of all is clearance of a minefield. During World War II all manner of devices were tried out, from explosive projectors to brutally simple machines like flails and rollers. Despite their inability to guarantee safe passage through the mines, no better solutions have been found in the four decades since 1945.

The land mine in its modern form was first used during World War I, and almost as soon as the first tanks appeared on the battlefield the Germans were designing the first anti-tank mines. Between the wars the land mine was gradually developed to the point where it could be handled and used by almost every soldier in any army but in most armies the engineers were given the task of laying large-scale minefields.

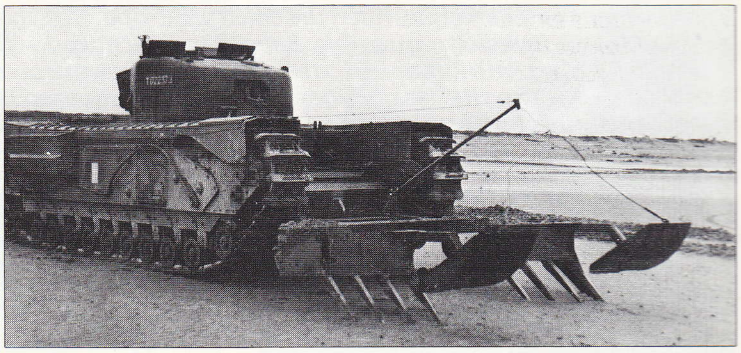
In armoured warfare the main type of mine encountered is the anti-tank mine; the much smaller and lighter anti-personnel mine can cause little damage to even the lightest tanks. The main objective when laying anti-tank minefields is not primarily to damage enemy tanks (although that is always a bonus) but to inflict delays on advancing armoured forces. By inflicting delay the all-important forward momentum of an armoured advance is lost and with it the shock effect that makes the tank such a potent weapon. Of course, an advancing force can simply travel around a minefield, but if the minefield has been properly laid and planned this is not possible, for the minefield's flanks should be based either on strongly-held positions or on natural obstacles such as water barriers. Under such circumstances the enemy has to try to clear a path through the minefield and, again, if the minefield has been correctly positioned clearance is not easy. It is one of the basic rules of warfare that an obstacle not covered by fire is useless and that goes for minefields as well, so the enemy normally has the prospect of having to clear the offending minefield while under fire from the defenders.

Clearing land mines takes time, and it is the task of the combat engineer to reduce that time to a minimum. He has several clearance methods available to him. His problem is that the safest and most certain clearance method is also the most time-consuming, a fact just as certain during World War II as it is today: this is the lengthy and rather hazardous process of searching for the mines by hand, using prods and shovels. In a well-laid out minefield this can be made even more time-consuming by scattering anti-personnel mines at variable intervals. It is the method least suitable for use during armoured warfare so the combat engineer has recourse to other methods that can clear mines but are much less certain of complete clearance.

Rollers and ploughs

At the beginning of World War II the combat engineer had only two non-manual methods open to him: the roller and the plough. The rollers were pushed in front of a tank by means of a frame, but the early forms of roller had several faults that were only appreciated once they were actually used to clear mines. One was that the rollers had to follow the contours of the ground surface very closely: if they rolled above small dips or gullies they might miss mines that the tank tracks would find to their cost. The other fault was that the rollers were not always heavy enough. Most anti-tank mines only detonated when a pressure of over about 120 kg (265 lb) was applied, and infantry could cross an anti-tank minefield in relative safety unless the usual practice of 'sowing' anti-personnel mines had been followed. Thus the rollers had to be really heavy, and if they were heavy they became a prodigious load to push in front of a tank, to say nothing of the difficulties of steering control. It was not until well after World War II that the problems associated with mine rollers were finally eradicated by careful design and the use of articulated arms.

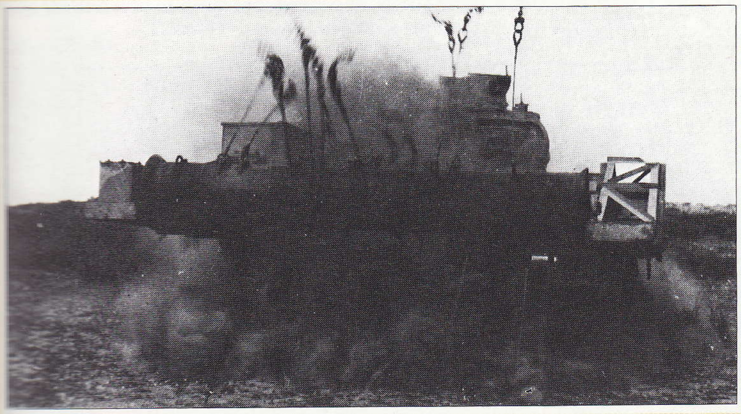
This gave rise to the mine plough. The British were quite early in developing such devices and carried out a whole series of trials with various forms of agricultural plough to determine exactly what form a mine plough should take. From these early trials came several forms of special plough mounted on frames, some being designed to fit onto mine roller frames in the interests of commonality. All of these ploughs were intended to be pushed in front of the carrier tank tracks and dig down into the ground. As they did so they were supposed to lift out any mines they came across and push them to one side, out of the way. They had the advantage of clearly indicating to following troops or vehicles exactly what path had been cleared, but once again there were drawbacks. One was that the plough was not a 100 per cent clearance method. Once again variations in ground contours often meant that mines could be missed. The other drawback was encountered in rocky ground. At the best of times and under perfect soft soil conditions the early mine ploughs were difficult to push and usually involved the pusher tank having to crawl forward at high revolutions and in bottom gear. On rocky ground it became almost impossible to push a plough, and if it struck a rock or tree root something usually had to give, normally the ploughshare or a fixing bracket.



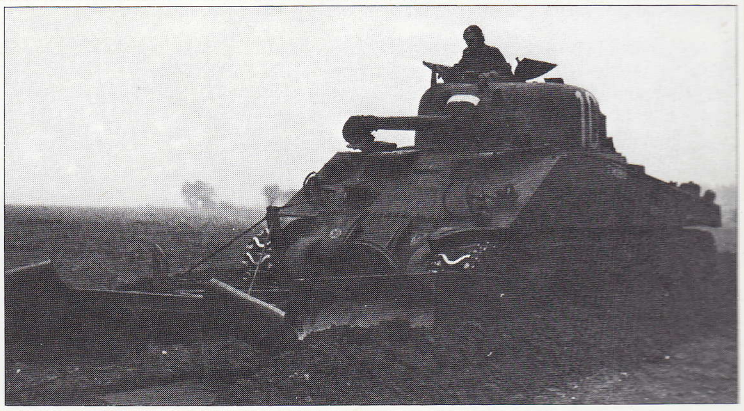
The Jeffries (or MDI) plough was one type of mine plough used for trials by the 79th Armoured Division. The plough shares were carried on the ends of arms that could be folded upwards when not in use, but the type did not get past the experimental stage as the Bullshorn plough was preferred.

It was left to a South African engineer officer to invent what became the almost universally accepted method of clearance in use during World War II. This was the mine flail, which in theory should have been simple. It was a series of chains around a drum rotated by some power source carried on the clearing tank, usually the tank's main engine via a power take-off or an auxiliary engine. After early experience in North Africa the flail became widely accepted by the British army, and was even taken over by the US Army. But early experience as usual highlighted the drawbacks as well. One of these involved the chains, which had a tendency to tangle up with one another or to break up into pieces. The chains also showed a propensity to beat the ground in uneven patterns that sometimes left patches of ground unbeaten, and when they did not beat the ground there was always a chance that a mine might have been missed. These and other problems involved the British army in a great deal of trials work which evolved a method of using flail chains that not only detonated mines by simply hitting them with the end of the chain but also dug up the ground and extracted the mines to be broken up by further beating. In time the Crab flail became the standard model.

At the same time as the flail tanks were being evolved, the use of explosives was also being developed. Bangalore Torpedoes were a time-honoured method of clearing mines and they reached a high point of efficiency with massive and awkward devices such as the Snake. More sophisticated were the various hose devices that were somehow emplaced across a minefield. These hoses could either be fired across the minefield by a rocket or dragged across by a roller or flail tank. Once in position they were filled with liquid explosive (as in Conger), or had their explosive payloads already in place (as in Tapeworm). In either case the resultant explosion was virtually certain to detonate any mines in the immediate vicinity by blast alone. However, it was still only about 97 per cent certain to produce a clear path and in combat the remaining three per cent had to be accepted.



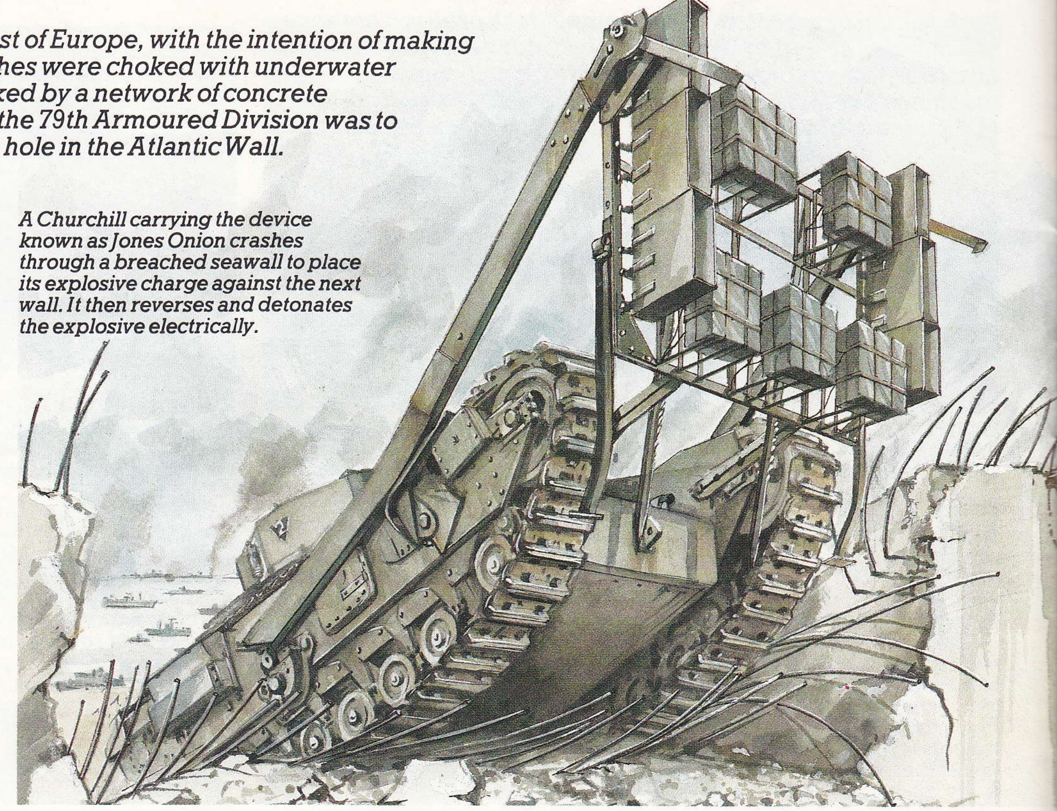
The Matilda Scorpion rotary mine flail was developed in North Africa during 1942, and is seen here operating east of the Mareth Line in 1943. The flail drum and chains were rotated by two engines, one each side of the hull, and were most effective at detonating mines, but the chains often gave trouble.



The Bullshorn plough was a mine plough device developed within the 79th Armoured Division. It was more usually fitted to the Churchill AVRE and not the Sherman tank shown here, although it was developed to be used by both the Churchill and the Sherman.

Storming the Atlantic Wall

The Germans extensively fortified the coast of Europe, with the intention of making an amphibious invasion impossible. Beaches were choked with underwater obstacles, sowed with mines and overlooked by a network of concrete emplacements. The vital task assigned to the 79th Armoured Division was to spearhead the British assault and punch a hole in the Atlantic Wall.



A Churchill carrying the device known as Jones Onion crashes through a breached seawall to place its explosive charge against the next wall. It then reverses and detonates the explosive electrically.

When the first waves of the special vehicles of the 79th Armoured Division swept ashore on the Normandy beaches on 6 June 1944, it was the highpoint of a long process of training and preparation that had in some cases been going on for years. In the event it was in most cases a practical demonstration of the old military maxim 'train hard, fight easy', for the men and machines of the 79th Armoured Division had been working up to the invasion through a long series of exercises, tactical analysis and individual training sessions.

The 79th Armoured Division was formed in September 1942, and at that time it was expected that it would be a conventional armoured formation. But by early 1943 its role had been altered. This was a direct result of the realization that the only way Germany was to be beaten in Europe was by means of land operations preceded by a large amphibious operation to get armies ashore. By early 1943 the shape and form of Hitler's Atlantic Wall was becoming known, and it was realized that the only way to get through the mass of obstacles, concrete defences and weapon emplacements was by means of special armoured vehicles and the use of specialized tactics. Exactly what form these vehicles and tactics might take was then unknown. The 79th Armoured Division was given the job of discovering them, preparing to use them, and actually carrying out the role on the day of the invasion.

Hobart

So the 79th Armoured Division had to start completely from scratch, but it had a major advantage in that it was commanded by Major-General Sir Percy Hobart, one of the most remarkable officers in a remarkable generation of army officers. His drive, organization and overall direction enabled the untrained and unprepared 79th Armoured Division to become one of the most successful armoured formations of World War II, but it was to be a long and arduous slog.

On the equipment side there was virtually nothing to hand. World War I had seen the use of some specialized armour, but the end of the war and years of treasury cost-cutting had ensured that little had survived the inter-war years. Some experimental work had been carried out in the UK in the years just before 1939, but the results were few and were not really intended for the sort of warfare the 79th Armoured Division was contemplating. Special equipment had to be developed from the drawing board onwards, but ready to hand were the Canal Defence Lights (CDLs) which became an early component of the 79th Armoured Division's inventory. Since they played little part in the invasion plot they can be left out of the rest of this account.

One piece of equipment was the swimming tank. It was appreciated that tanks would have to move ashore in the early assault waves, and as it might not be possible to land them directly on a beach they would have to swim ashore somehow. From this came the Duplex Drive (DD) tanks, usually Shermans, with their high collars that enabled them to float in relatively calm waters, moved by twin propellers at the rear. Then there was the need for an armoured vehicle type to provide combat engineers with some form of protection while they carried out their myriad tasks, and in time the Armoured Vehicle Royal Engineers (AVRE) was born. Minefields would be an obvious obstacle, and mine-clearing tanks with their various forms of attachment or flail systems had to be developed. All manner of special equipment had to be devised, from assault bridging to obstacle demolition charges.

Then men had to be found from a manpower pool that was even by 1943 beginning to run dry. Men were needed everywhere and the 79th Armoured Division, despite its importance, had to take what was available. Fortunately they got some of the best and the division began to take shape. The 35th Tank Brigade was given the task of looking after the CDLs, and when the mineclearing equipment had been decided upon the 30th Armoured Brigade were given Sherman Crabs. The AVREs became the responsibility of the three assault regiments of the 1st Assault Brigade. The 27th Armoured Brigade took over the DD tanks and the 31st Tank Brigade assumed responsibility for a miscellany of vehicles including the flamethrowers.

The flamethrowers are not mentioned elsewhere in this study, but were an important component of the 79th Armoured Division. Most of the equipments involved were known as Crocodiles based on the Churchill tank and using flame projectors fed from armoured trailers towed behind each tank. They were intended to be used against bunkers and similar strongpoints, but their use in action proved one of the more specialized skills that the 79th Armoured Division had to learn. Another useful

On 6 August 1944 a Churchill AVRE moves up through the village of Oudenfontein in Normandy. Once the AVREs had shown what they could do during the Normandy campaign they became an established part of the British armoured formations, and were constantly in demand for all manner of combat engineer tasks.

vehicle was the Buffalo, a large tracked amphibian that could carry anything from men to supplies, whose main attraction for the 79th Armoured Division was that it could drive straight out of landing craft and swim its way ashore to cross over the beach.

Tank training

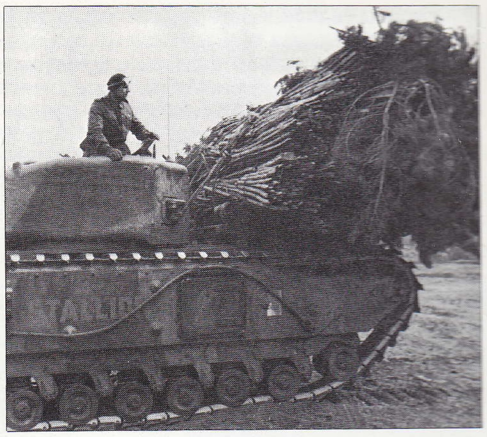
Out of all these various units, each with a different type of equipment and with differing tactical purposes, the 79th Armoured Division had to produce a cohesive fighting formation. It proved no easy task, for everything had to be carried out with virtually no background on which to work. It was decided to form instructional wings within the division and use these to formulate working methods, drills and all the other operational requirements. The first of these wings was formed at the delightfully-named Fritton Decoy near Lowestoft, where the division learned how to operate DD tanks from landing craft and worked out safety drills and the general handling of DD tanks in water. Not only specialized training was carried out, for many of the men allocated to the 79th Armoured Division were hardly out of the recruit training stage and had to be taught all the usual military skills in addition to their task skills. One form of training that was greatly emphasized was tank gunnery, for it was realized that in the initial stages of the assault on the beaches the tanks themselves would have to provide their own fire support and that they would have to knock out the many beach defence weapons that it was known the Germans had emplaced along the Atlantic Wall. The standard of gunnery was such that gunners were expected to be able to hit German gun barrels with their opening shots.

By the summer of 1943 the 79th Armoured Division carried out its first large-scale training exercises at Linney Head in Wales, and for the first time the division worked together as a cohesive whole. It was at this time that the individual units realized that each of them depended on the other for combat success, and from this realization came yet more lessons that had to be worked into the division's operating methods and drills. After Linney Head the division once more separated for yet more training, some of it carried out in Stokes Bay in the Solent. By the end of 1943 the first Crabs were issued to the division, and training with these took up more time.

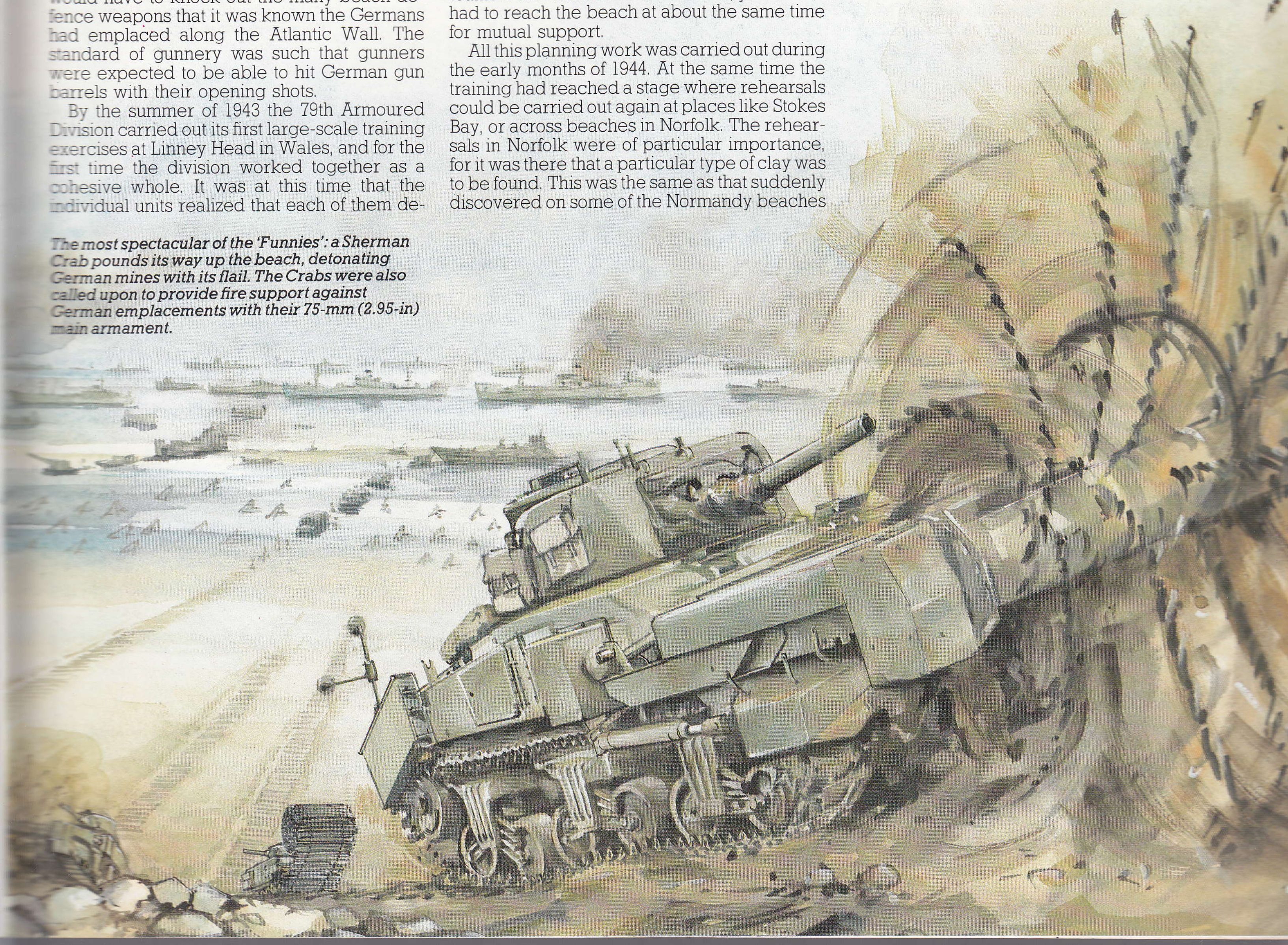
Timing the landing

By then it was apparent that the actual invasion day was not far distant, and information regarding the invasion beaches was pouring into the division's planning staffs. The Royal Air Force provided a constant stream of low-level photographs, and daring raids by commando teams produced actual dimensions of the types of beach and other obstacles that the division would have to face. Replicas of these obstacles were built on a training range at Orford in Suffolk and were used to determine exactly how they could be tackled. In this way the division began to lay out exactly what equipment such as bridging would be required, and even got down to the task of determining which vehicles would be in any particular landing craft at each stage of the landings. The actual timings of the landings was evolved for the first time, it being appreciated that not everything could be landed all at the same time. For various reasons the DD tanks had to be launched some way out to sea while the division assault teams were landed much farther in, yet the two had to reach the beach at about the same time for mutual support.

All this planning work was carried out during the early months of 1944. At the same time the training had reached a stage where rehearsals could be carried out again at places like Stokes Bay, or across beaches in Norfolk. The rehearsals in Norfolk were of particular importance, for it was there that a particular type of clay was to be found. This was the same as that suddenly discovered on some of the Normandy beaches



A Churchill AVRE carries a brushwood fascine to be dumped into a trench or ditch to allow the AVRE and other vehicles to cross. When these fascines were being carried neither the driver nor the commander could see very much, so the commander usually had to travel on top of the fascine and give the driver intercom commands.



The most spectacular of the 'Funnies': a Sherman Crab pounds its way up the beach, detonating German mines with its flail. The Crabs were also called upon to provide fire support against German emplacements with their 75-mm (2.95-in) main armament.

by reconnaissance teams from the commando units. This clay was of a particularly soft consistency, and it was feared that it would not take the weight of a tank, a fact shown to be correct when a tank promptly sank into it while attempting to cross the similar clay on the Norfolk beaches. It was time for a rapid improvisation, and Churchill AVREs were hurriedly fitted with carpet-laying devices that would enable vehicles to cross the clay belts. The hessian mats and their dispenser bobbins were produced in the division's REME workshops, but in the event they were not really needed. On D-Day the clay belts had been covered by sand churned up by the rough weather.

Across the Channel

During early June 1944 the 79th Armoured Division took its turn in the long lines of traffic that moved to the invasion ports along the south coast of England. The 79th Armoured Division had to disperse itself quite widely, for by the very nature of its operational task it had to land on every beach on which British and Allied troops would be using. The 79th Armoured Division was thus divided among three divisions. On the west the British 50th Division would be landing on 'Jig' and 'King' beaches, in the centre the 3rd Canadian Division would be landing on 'Mike' and 'Nan' beaches, while in the east the British 3rd Division would be landing on a brigade front on 'Queen' beach. The odd thing was that the highly specialized 79th Armoured Division was the only formation of its kind to be landing on the invasion day. The US Army had decided not to employ specialized vehicles other than DD tanks, and relied entirely upon their ordinary divisional resources. In part this was due to the fact that many of the beaches they were to use were backed by cliffs or other terrain where armour of any sort would be difficult to use, but in places specialized armour would have proved invaluable.

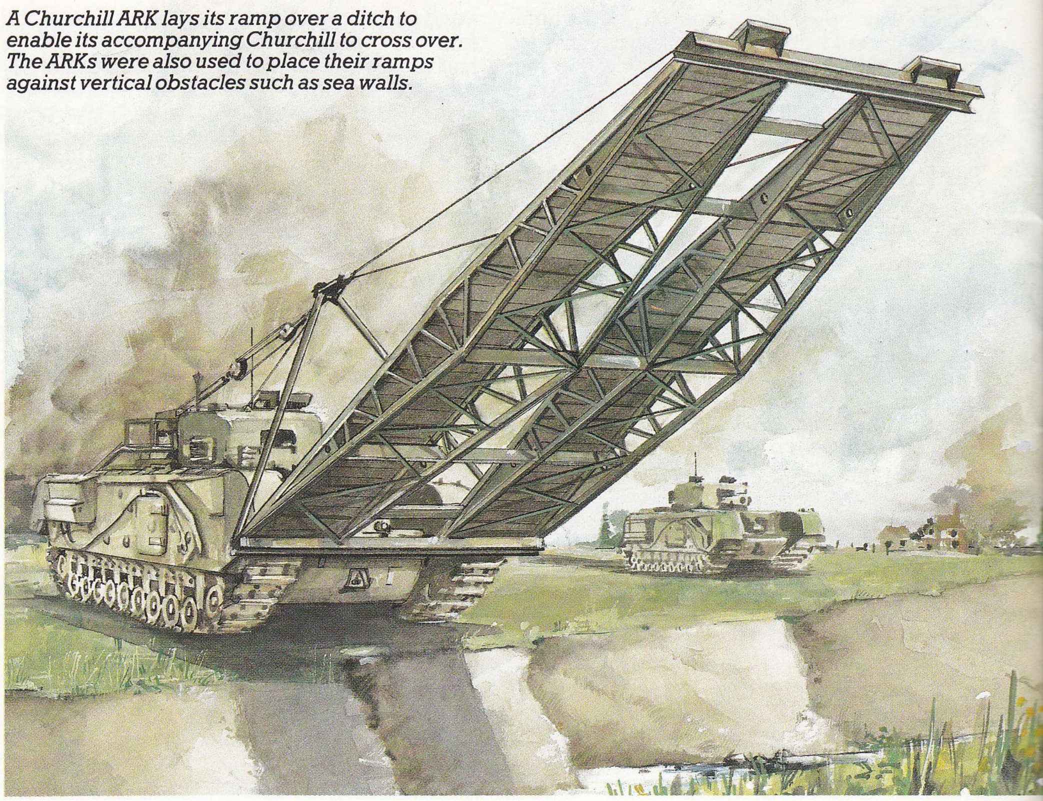
Rough sea

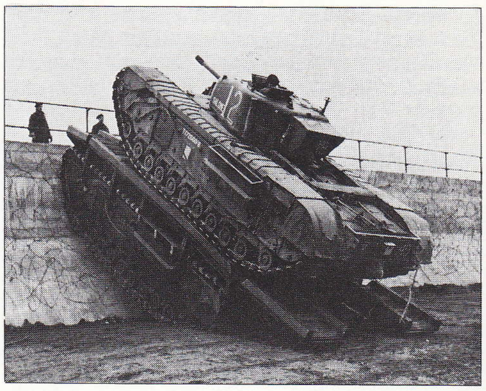
In due course the vehicles of the 79th Armoured Division made their way onto their landing craft and the men then had to simply settle down and wait. They had to wait longer than expected, for on 4 June the weather turned foul and the Channel was too rough for the landing craft involved, and certainly too rough for the DD tanks which could not operate in anything more than sea state 5. Thus the invasion was postponed for one whole day until, gradually, the weather abated and the fleet set sail.

On the morning of 6 June all the training came to fruition. On almost every beach the carefully rehearsed drills were used and proved entirely successful. Of course things did go wrong in places, especially on the western beaches where the sea was so rough that it proved impossible to launch the DD tanks and the assault teams had to provide their own fire support. Not surprisingly, the carefully-laid plans were set aside and improvisation and common sense had to be used. It was here that all the training was shown to be fully justified. Tactics were rapidly evolved to overcome the defences at the same time as the obstacles were cleared, and the Crab Shermans proved invaluable with their 75-mm guns. In the centre, some of the minefields proved to be particularly difficult to clear and the mine-clearing teams suffered heavy casualties in men and equipment before they won through with the close support provided by accompanying Canadian infantry.

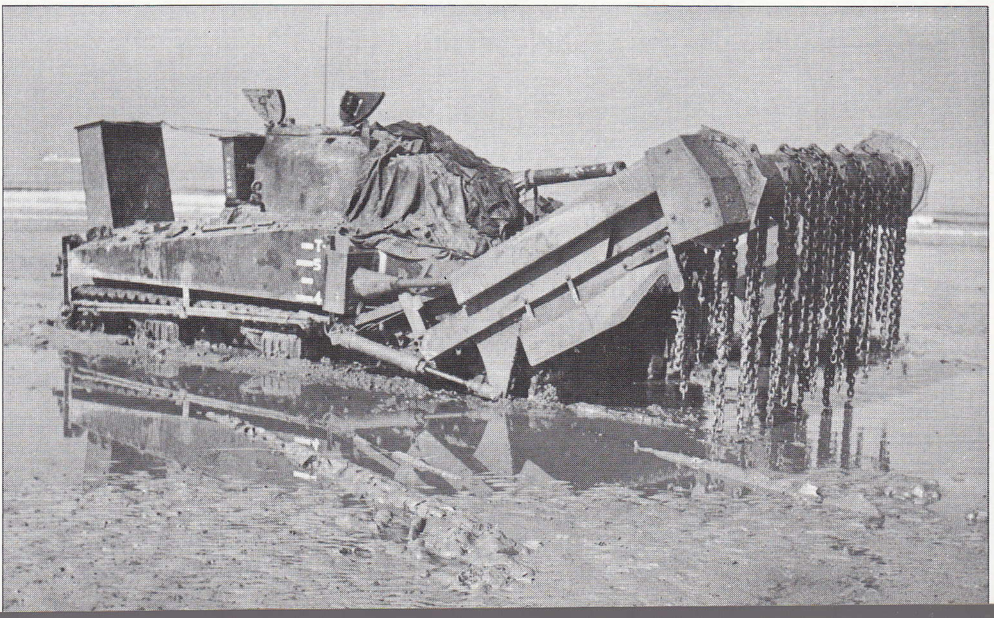
By nightfall some Allied troops were nearly 10 km (6 miles) inland and much of this advance was due to the success of the 79th Armoured Division in clearing paths across and from the beaches. In contrast the Americans to the west were at best only 5 km (3 miles) inland and they had suffered proportionally far greater casualties. This alone provides a yardstick of the success of the 79th Armoured Division, but it should not be forgotten that much of their success was due to the fact that their preparation had been so thorough that the invasion came easy.

A Churchill ARK lays its ramp over a ditch to enable its accompanying Churchill to cross over. The ARKs were also used to place their ramps against vertical obstacles such as sea walls.





A Churchill tank negotiates a sea wall built at Orford in Suffolk to simulate the types of wall likely to be encountered by the 79th Armoured Division in northern France. The Churchill is climbing over a Churchill ARK Mk I that has been driven against the wall.



Soft sand was always one of the specialist tanks' most-feared terrain, and what could happen when crossing such terrain is clearly shown in this photograph of a bogged-down Sherman Crab. Note the deep wading gear fitted to the engine intakes at the rear and the flails in the raised position.

GERMANY

Bergepanther

During the early war years the German army used the 18-tonne SdKfz 9/1 and 9/2 for recovering broken-down or damaged tanks, but with the arrival of the heavy tanks such as the Tiger and Panther these vehicles were no longer able to recover the weights involved. The only way they could be used effectively was in complicated tandem or other arrangements with one vehicle's crane acting in combination with the other, and it was not always possible to get two of these large halftracks to some locations, even supposing two were on hand. The only solution to the problem of large vehicle recovery was the development of a new heavy recovery vehicle. Some of the early Tiger units converted their machines to take winches in the turret in place of the main gun for recovery purposes, but this was a waste of a valuable gun tank and Tigers were always in short supply. In the end it was decided to use the Panther tank as the basis for the new vehicle.

The new vehicle became known as the **SdKfz 179 Bergepanther**, or **Bergepanzer Panther**. The first of these appeared during 1943, and they were conversions of early models of Panther gun tanks. On the conversion the turret and fighting compartments were completely removed and replaced by an open superstructure housing a large and powerful winch. To increase the 'pull' of this winch the vehicle had at the rear a large earth spade. In use this spade was lowered to the ground and the vehicle was reversed, the spade thus being dug down into the ground to act as a stable anchor when the winch was in use with the cable running out over the vehicle rear. The combination of spade and winch enabled the Bergepanther to recover even the heaviest vehicles, and it also carried all manner of other recovery equipment, including a light crane jib on the left-hand side for use when carrying out running repairs.

It was spring 1944 before the first Bergepanthers reached the troops, the conversions being carried out by DEMAG in Berlin. By the time the war ended 297 had been produced, but not all of them were fully equipped. For supply reasons some vehicles were issued without the rear-mounted spade which reduced them to little more than towing vehicles; they were of such limited utility that many of these incomplete vehicles had their winches removed to enable them to be employed as supply and ammunition carriers. The full standard Bergepanthers proved to be invaluable and not surprisingly they were concentrated in Panther, Tiger and Königstiger formations. In service they had a crew of five, and most retained their front hull 7.92-mm (0.312-in) machine-gun. Many were also armed with a 2-cm cannon carried just forward of the open superstructure on a mount that allowed it to be used either in the anti-aircraft or ground target role.

When they were first introduced the Bergepanthers were well in advance of other contemporary recovery vehicles. Although it was a conversion of an existing tank, its combination of winch, earth spade and overall layout meant that it was quite simply the best recovery vehicle produced during World War II.

Specification

Bergepanther

Crew: 5

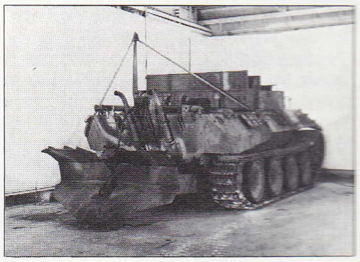
Weight: 42 tons

Powerplant: one Maybach HL210 P.30 petrol engine developing 478.7 kW (642 hp)

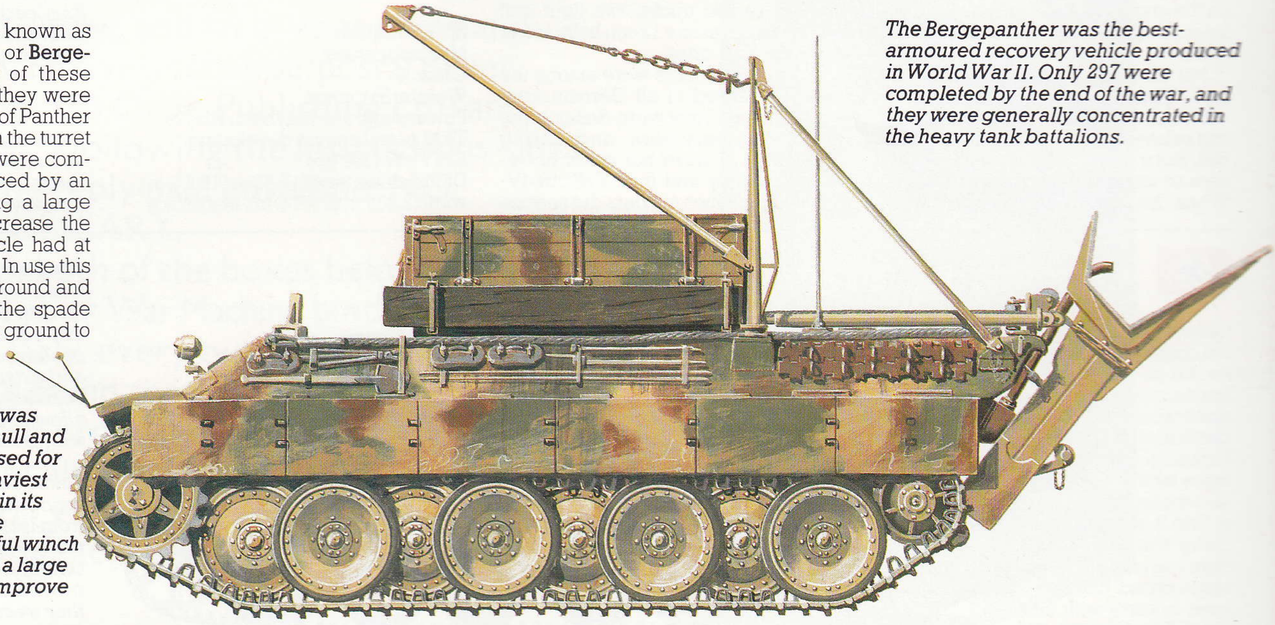
Dimensions: length 8.153 m (26 ft 9 in); width 3.276 m (10 ft 9 in); height 2.74 m (9 ft)

Performance: maximum road speed 32 km/h (20 mph); maximum road range 169 km (105 miles) maximum cross-country range 85 km (53 miles)

Armament: one 2-cm cannon and one 7.92-mm (0.312-in) machine-gun



The Bergepanther was the best-armoured recovery vehicle produced in World War II. Only 297 were completed by the end of the war, and they were generally concentrated in the heavy tank battalions.



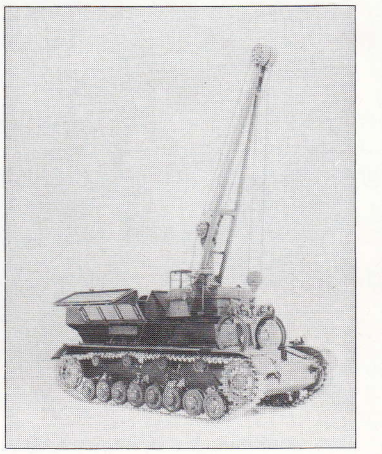
The German Bergepanther was based on the Panther tank hull and suspension, and could be used for the recovery of even the heaviest German tanks. Shown here in its travelling configuration, the Bergepanther had a powerful winch in the hull interior and used a large earth anchor at the rear to improve winch pull.

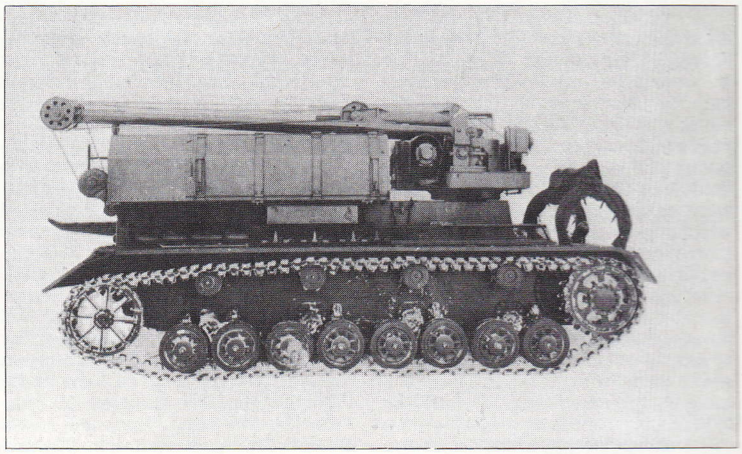
GERMANY

Karl ammunition carriers

When the design teams that produced the massive Karl siege howitzer were drawing up their plans they at first overlooked one item: the massive short-barrelled howitzers they were producing were mounted on large tracked chassis to provide some measure of mobility (even though this mobility was strictly limited by the sizes and weights involved), but they forgot the matter of ammunition supply. This oversight was soon realized and plans were made to provide special ammunition carriers that could move to wherever the Karls might be emplaced, and these carriers had to be tracked as well. They also had to be large, for the Karls fired a huge concrete-busting projectile that weighed no less than 2170 kg (4,784 lb) and with a calibre of 60 cm (23.62 in); later versions had a calibre of 54 cm (21.26 in) and the projectile weighed 1250 kg (2,756 lb).

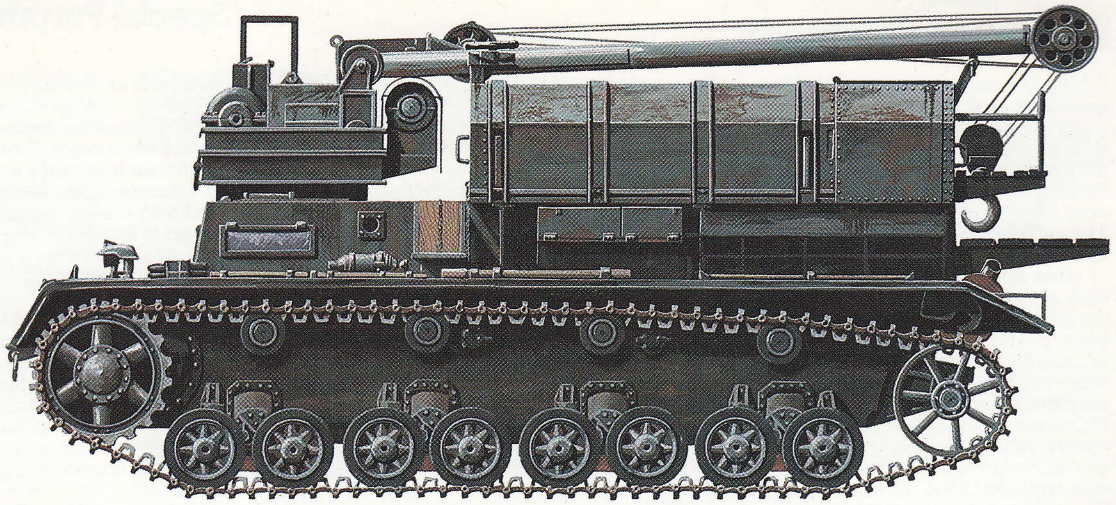
The vehicle selected to be the ammunition carrier for the Karls was the PzKpfw IV Ausf F. These vehicles were not conversions, but were built from new using the basic tank hull, suspension and other components, though in place of the usual turret there was a platform that covered the entire top of the hull. At the front of the platform was a crane with a capacity of 3000 kg (6,614 lb), offset to the left and with the swivelling jib normally stowed





Above left: the Munitionpanzer IV Ausf F was used to carry the heavy projectiles for the 60-cm (23.62-in) Karl self-propelled mortar, and is seen here with its lifting jib raised ready for use. The jib could traverse through 360 degrees.

Above: A Munitionpanzer IV Ausf F is shown in its travelling configuration with the jib folded and with the shell lifting grab stowed on the front of the hull. Each of these ammunition carriers could carry three 60-cm (23.62-in) projectiles.



The Munitionpanzer IV Ausf F carried shells for the Karl self-propelled mortar on a platform over the hull. They were lifted onto the Karl loading tray by a front-mounted jib crane, seen here folded over the shell platform.

facing to the rear. The main platform was used as the carrying area for the projectiles, with space for two or three shells. Small metal side walls were fitted, but these were often removed in the field.

Much of the movement of the Karl equipments had to be carried out on railways, and the train that carried the components of Karl also had a couple of flat-cars to carry **Munitionpanzer** or **Munitionschlepper** ammunition carriers. Once close to the firing position the Karls were assembled and they moved off to the exact firing position. Projectiles for the weapons were taken from the train box-cars either by overhead gantry or by using the crane mounted on the carriers. The carriers then moved to the firing position and unloaded their projectiles by parking next to the Karl breech and lifting the ammunition directly to the breech loading tray with the crane. Special ammunition handling grabs were used on the crane itself. Once their load had been fired the carriers trundled off for more.

Not all Karl moves were made by rail. There was an arrangement whereby a Karl could be broken down into relatively small loads for road traction, but it was a long and arduous process to assemble the weapon on site. When this occurred the carriers were towed on special wheeled trailers towed by large halftracks. The usual allotment of carriers to a single Karl was two. Also included in each Karl 'train' were two trucks, two light staff cars and at least one 12-ton halftrack to carry the Karl crew.

The Karl howitzers were among the most specialized of all German artillery weapons. They were designed as fortification smashers, and during World War II were not much in demand. But they and their PzKpfw IV-based ammunition carriers did see use during the siege of Sevastopol, and in 1944 saw more action during the Battle of Warsaw against the unfortunate Polish home army.

Specification

Munitionpanzer

Crew: 4

Weight: 25 tonnes

Powerplant: one Maybach HL 120 TRM petrol engine developing 223.7 kW (300 hp)

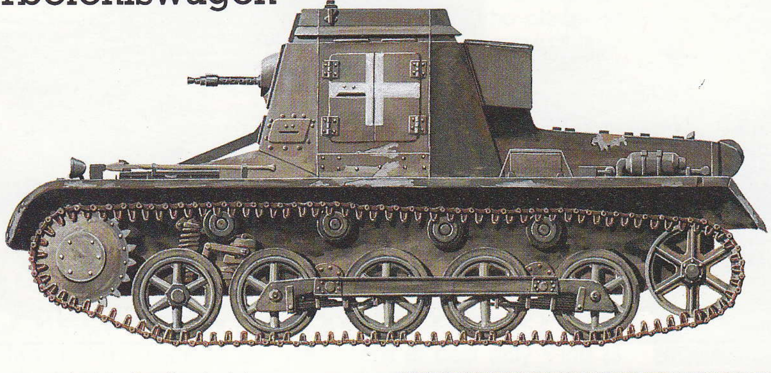
Dimensions: length 5.41 m (17 ft 9 in); width 2.883 m (9 ft 5.5 in); height not recorded

Performance: maximum road speed 39.9 km/h (24.8 mph); maximum road range 209 km (130 miles)

Armament: none

GERMANY

kleiner Panzerbefehlswagen



The kleiner Panzerbefehlswagen was a command version of the PzKpfw I light tank. It had a crew of three and the fixed superstructure contained two radios, a map table and extra electrical equipment. The vehicles were widely used, as they allowed commanders to keep up with armoured formations.

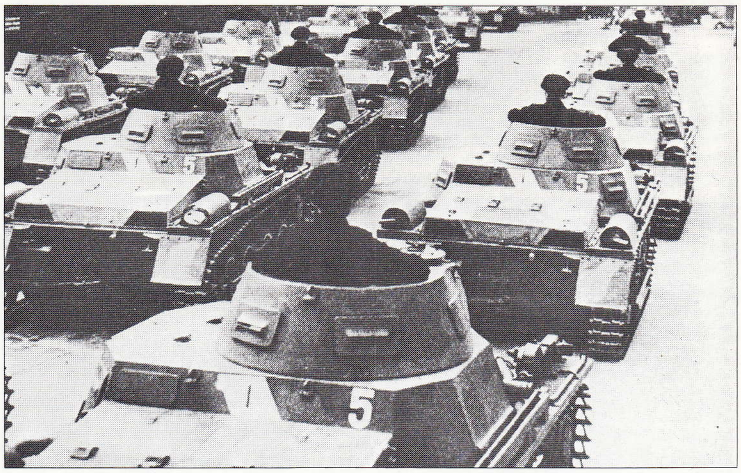
Once the German army had accepted the concept of the Panzer division with its large tank component it was appreciated that the large mass of tanks would carry with it considerable command and control problems. Tank formation commanders would have to move forward with the tanks and maintain contact with them at all times, and at first it seemed that the best way of doing this was to have the commanders travelling in tanks. But it was also appreciated that commanders would have to carry with them all manner of special equipment and extra personnel to transmit orders and generally assist the commander in his task. Thus some form of dedicated command tank would be needed.

In typically thorough style the German designers came up with an answer as early as 1938. They decided to convert the little PzKpfw I training tank for the command role, and the result was the **SdKfz 265 kleiner Panzerbefehlswagen** (small armoured command vehicle). The command vehicle was a relatively straightforward conversion of the basic tank in which the rotating tank turret was replaced by a box-like superstructure to provide extra internal space. The crew was increased from the two of the tank to three, in the form of the driver, the commander and a signaller/general assistant. The extra internal space was taken up with items such as a small table for the commander to work on, map display boards, stowage for more maps and other paperwork, and two radios, one for communicating with the tanks and the other to provide a link to higher command levels. These radios required the provision of extra dynamo capacity to power them and keep their associated batteries fully charged. For armament a 7.92-mm (0.312-in) MG34 machine-gun was mounted in the front plate.

There were three variations of this command vehicle, one with a small rotating turret set onto the superstructure. This latter feature was soon discontinued as it took up too much of the limited internal space and was soon found to be unnecessary. The other two variants differed only in detail. In all of them the small size of the vehicle inflicted space limitations, and with two men attempting to work within the close confines of the body things could get very cramped. But the concept worked very well and about 200 conversions from the PzKpfw I tank were made. The first of them saw action during the Polish campaign of 1939 and more were used in France during May and June 1940. Later they equipped the Afrika Korps. One of these North African campaign examples was captured by the British army and taken back to the United Kingdom. There it was closely examined by tank experts who produced a large report on the vehicle, which can now be seen in the Bovington Tank Musem.

Despite their relative success in the command role the little PzKpfw I tank conversions were really too small and cramped for efficiency and in time they were replaced by conversions of larger tank models.

Below: Just how cramped the PzKpfw I command tank was can be gauged from this photograph of the basic model PzKpfw I. About 200 conversions were made but they proved too small for the task, and they were replaced by modified versions of later tanks.



Specification

kleiner Panzerbefehlswagen I

Crew: 3

Weight: 5.8 tons

Powerplant: one Maybach NL 38 TR petrol engine developing 74.6 kW (100 hp)

Dimensions: length 4.445 m (14 ft 7 in); width 2.08 m (6 ft 9.9 in); height 1.72 m (5 ft 7.7 in)

Performance: maximum road speed 40 km/h (25 mph); maximum road range 290 km (180 miles)

Armament: one 7.92-mm (0.312-in) machine-gun